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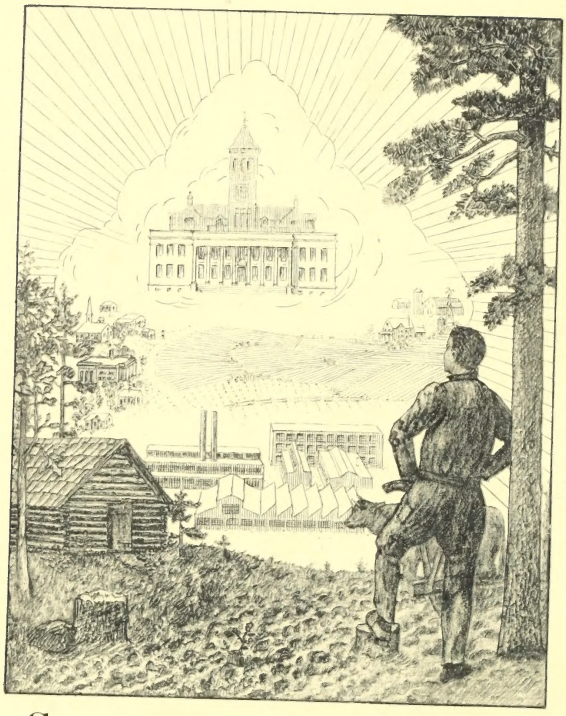

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1914

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WATER-SUPPLY PAPER 304

SURFACE WATER SUPPLY OF THE UNITED STATES

1911

PART IV. ST. LAWRENCE RIVER BASIN

PREPARED UNDER THE DIRECTION OF M. O. LEIGHTON

BY

C. C. COVERT AND R. H. BOLSTER

WASHINGTON
GOVERNMENT PRINTING OFFICE
1912

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SURFACE WATER SUPPLY OF THE ST. LAWRENCE RIVER BASIN, 1911.

By C. C. Covert and R. H. Bolster.

AUTHORITY FOR THE WORK.

This volume is Part IV of a series of 12 reports presenting results of measurements of flow made on certain streams in the United States during the calendar year 1911. The reports are listed in the following table:

Papers on surface water supply of the United States, 1911.

Part.[a]	No.	Title.
I	301	North Atlantic coast.
II	302	South Atlantic coast and eastern Gulf of Mexico.
III	303	Ohio River basin.
IV	304	St. Lawrence River basin.
V	305	Upper Mississippi River and Hudson Bay basins.
VI	306	Missouri River basin.
VII	307	Lower Mississippi River basin.
VIII	308	Western Gulf of Mexico.
IX	309	Colorado River basin.
X	310	Great Basin.
XI	311	Pacific coast in California.
XII	312	North Pacific coast.

[a] For the purpose of uniformity in the presentation of reports, a general plan has been agreed upon by the United States Reclamation Service, the United States Forest Service, the United States Weather Bureau, and the United States Geological Survey, according to which the area of the United States has been divided into 12 parts, whose boundaries coincide with natural drainage lines indicated by the parts of the report.

The data presented in these reports were collected by the United States Geological Survey under authority implied in the organic law (20 Stat. L., p. 394), which contains the following paragraph:

Provided, That this officer [the Director] shall have the direction of the geological survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

The work was begun in 1888 in connection with special studies of water supply for irrigation.

Since the fiscal year ending June 30, 1895, successive sundry civil bills passed by Congress have carried the following item and appropriations.

For gaging the streams and determining the water supply of the United States and for the investigation of underground currents and artesian wells and for the preparation of reports upon the best methods of utilizing the water resources.

Annual appropriations for the fiscal year ending June 30—

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911 to 1913, inclusive	150,000

In the execution of the work many private and State organizations have cooperated. Acknowledgments for such cooperation are made on pages 13–14, and also in connection with the description of each station affected by the cooperative work.

PUBLICATIONS.

Measurements of stream flow have been made at nearly 2,000 points in the United States, and also at many points in small areas in Seward Peninsula and the Yukon-Tanana region, Alaska, and in the Hawaiian Islands. During 1911 gaging stations were maintained by the Survey and the cooperating organizations at about 1500 points in the United States, and many discharge measurements were made at other points. In connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country, and will be made available in the regular surface water supply papers from time to time. A complete list of the gaging stations maintained by the Survey to and including 1910, and a list of the papers relating to the water supply of the country, have been published by the Survey as Water-Supply Paper 280. An index to the reports containing stream-flow measurements prior to 1904 has been published as Water-Supply Paper 119.

For each calendar year there has been prepared a report embodying the stream-flow data collected during that year, which has been published either as a part of the Annual Report of the Director, as a bulletin, or as a water-supply paper, as shown by the following table:

Stream-flow data in reports of the United States Geological Survey.

[A=Annual Report; B=Bulletin; WS=Water-Supply Paper.]

Report.	Character of data.	Year.
10th A, pt. 2	Descriptive information only	
11th A, pt. 2	Monthly discharge	1884 to Sept., 1890.
12th A, pt. 2	do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
WS 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
WS 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
WS 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
WS 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
WS 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
WS 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
WS 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A, pt. 4	Monthly discharge	1900.
WS 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
WS 75	Monthly discharge	1901.
WS 82 to 85	Complete data	1902.
WS 97 to 100	do	1903.
WS 124 to 135	do	1904.
WS 165 to 178	do	1905.
WS 201 to 214	Complete data, except descriptions	1906.
WS 241 to 252	Complete data	1907–8.
WS 261 to 272	do	1909.
WS 281 to 292	do	1910.
WS 301 to 312	do	1911.

NOTE.—No data regarding stream flow are given in the 15th and 17th annual reports.

The table which follows gives, by years and drainage basins, the numbers of the papers on surface water supply published from 1899 to 1911. The data for any particular station will be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Me., 1903 to 1911, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, and 301, which contain records for the New England streams from 1903 to 1911.

Numbers of water-supply papers containing results of stream measurements, 1899–1911.

	1899 [a]	1900 [b]	1901	1902	1903	1904
North Atlantic coast (St. John River to York River)	35	47, [c] 48	65, 75	82	97	[d] 124, [e] 125, [f] 126
South Atlantic coast and eastern Gulf of Mexico (James River to the Mississippi)	[g] 35, 36	48	65, 75	[g] 82, 83	[g] 97, 98	[f] 126, 127
Ohio River basin	36	48, [h] 49	65, 75	83	98	128
St. Lawrence River and Great Lakes	36	49	65, 75	[i] 82, 83	97	129
Hudson Bay and upper Mississippi River	36	49	[j] 65, 66, 75	[j] 83, 85	[j] 98, 99, 100	[j] 128, 130
Missouri River	[k] 36, 37	49, [l] 50	66, 75	84	99	130, [m] 131
Lower Mississippi River	37	50	[j] 65, 66, 75	[j] 83, 84	[j] 98, 99	[j] 128, 131
Western Gulf of Mexico	37	50	66, 75	84	99	132
Colorado River	[n] 37, 38	50	66, 75	85	100	133
Great Basin	38, [p] 39	51	66, 75	85	100	133, [q] 134
Pacific coast in California	38, [r] 39	51	66, 75	85	100	134
North Pacific coast	38	51	66, 75	85	100	135

	1905	1906	1907–8	1909	1910	1911
North Atlantic coast (St. John River to York River)	[d] 165, [e] 166, [f] 167	[d] 201, [e] 202, [f] 203	241	261	281	301
South Atlantic coast and eastern Gulf of Mexico (James River to the Mississippi)	[f] 167, 168	[f] 203, 204	242	262	282	302
Ohio River basin	169	205	243	263	283	303
St. Lawrence River and Great Lakes	170	206	244	264	284	304
Hudson Bay and upper Mississippi River	171	207	245	265	285	305
Missouri River	172	208	246	266	286	306
Lower Mississippi River	[j] 169, 173	[j] 205, 209	247	267	287	307
Western Gulf of Mexico	174	210	248	268	288	308
Colorado River	175, [o] 177	211	249	269	289	309
Great Basin	176 [q] 177	212, [q] 213	250, [q] 251	270, [q] 271	290	310
Pacific coast in California	177	213	251	271	291	311
North Pacific coast	[s] 177, 178	214	252	272	292	312

[a] Rating tables and index to Water-Supply Papers 35–39 continued in Water-Supply Paper 39.
[b] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52.
[c] Wissahickon and Schuylkill rivers to James River.
[d] New England rivers only.
[e] Hudson River to Delaware River, inclusive.
[f] Susquehanna River to Yadkin River, inclusive.
[g] James River only.
[h] Scioto River.
[i] Lake Ontario and tributaries to St. Lawrence River proper.
[j] Tributaries of Mississippi from east.
[k] Gallatin River.
[l] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.
[m] Platte and Kansas rivers.
[n] Green and Gunnison rivers and Grand River above junction with Gunnison.
[o] Below junction with Gila.
[p] Mohave River only.
[q] Great Basin in California, excepting Truckee and Carson drainage basins.
[r] Kings and Kern rivers and south Pacific coast drainage basins.
[s] Rogue, Umpqua, and Siletz rivers only.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups—(1) those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and discharge in second-feet per square mile, and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. The units used in this series of reports are second-feet, second-feet per square mile, run-off depth in inches and acre-feet. They may be defined as follows:

MAP OF UNITED STATES, SHOWING MEAN ANNUAL PRECIPITATION

Blue lines and figures indicate average annual precipitation in depth in inches

Prepared by Henry Gannett
mainly from data of the
United States Geological Survey

MAP OF UNITED STATES, SHOWING MEAN ANNUAL RUN-OFF

Blue lines and figures indicate average annual run-off in depth in inches

"Second-foot" is an abbreviation for cubic foot per second and is the unit for the rate of discharge of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the following table of equivalents.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off, depth in inches," is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

An "acre-foot" is equivalent to 43,560 cubic feet and is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation work.

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:

Table for converting discharge in second-feet per square mile into run-off in depth in inches over the area.

Discharge in second-feet per square mile.	Run-off in inches.				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.03719	1.041	1.079	1.116	1.153
2	.07438	2.083	2.157	2.231	2.306
3	.11157	3.124	3.236	3.347	3.459
4	.14876	4.165	4.314	4.463	4.612
5	.18595	5.207	5.393	5.578	5.764
6	.22314	6.248	6.471	6.694	6.917
7	.26033	7.289	7.550	7.810	8.070
8	.29752	8.331	8.628	8.926	9.223
9	.33471	9.372	9.707	10.041	10.376

NOTE.—For partial month multiply the values for one day by the number of days.

Table for converting discharge in second-feet into run-off in acre-feet.

Discharge in second-feet.	Run-off in acre-feet.				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	1.983	55.54	57.52	59.50	61.49
2	3.967	111.1	115.0	119.0	123.0
3	5.950	166.6	172.6	178.5	184.5
4	7.934	222.1	230.1	238.0	246.0
5	9.917	277.7	287.6	297.5	307.4
6	11.90	333.2	345.1	357.0	368.9
7	13.88	388.8	402.6	416.5	430.4
8	15.87	444.3	460.2	476.0	491.9
9	17.85	499.8	517.7	535.5	553.4

NOTE.—For partial month multiply the values for one day by the number of days.

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,317 gallons for one day.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day equals 86,400 cubic feet.
1,000,000,000 (1 United States billion) cubic feet equals 11,570 second feet for 1 day.
1,000,000,000 cubic feet equals 414 second-feet for one 28 day month.
1,000,000,000 cubic feet equals 399 second-feet for one 29 day month.
1,000,000,000 cubic feet equals 386 second-feet for one 30 day month.
1,000,000,000 cubic feet equals 373 second-feet for one 31 day month.
100 California miner's inches equals 18.7 United States gallons per second.
100 California miner's inches for one day equals 4.96 acre-feet.
100 Colorado miner's inches equals 2.60 second-feet.
100 Colorado miner's inches equals 19.5 United States gallons per second.
100 Colorado miner's inches for one day equals 5.17 acre-feet.
100 United States gallons per minute equals 0.223 second-foot.
100 United States gallons per minute for one day equals 0.442 acre-foot.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
$1\frac{1}{3}$ horsepower equals about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel realizing 80 per cent of theoretical power.

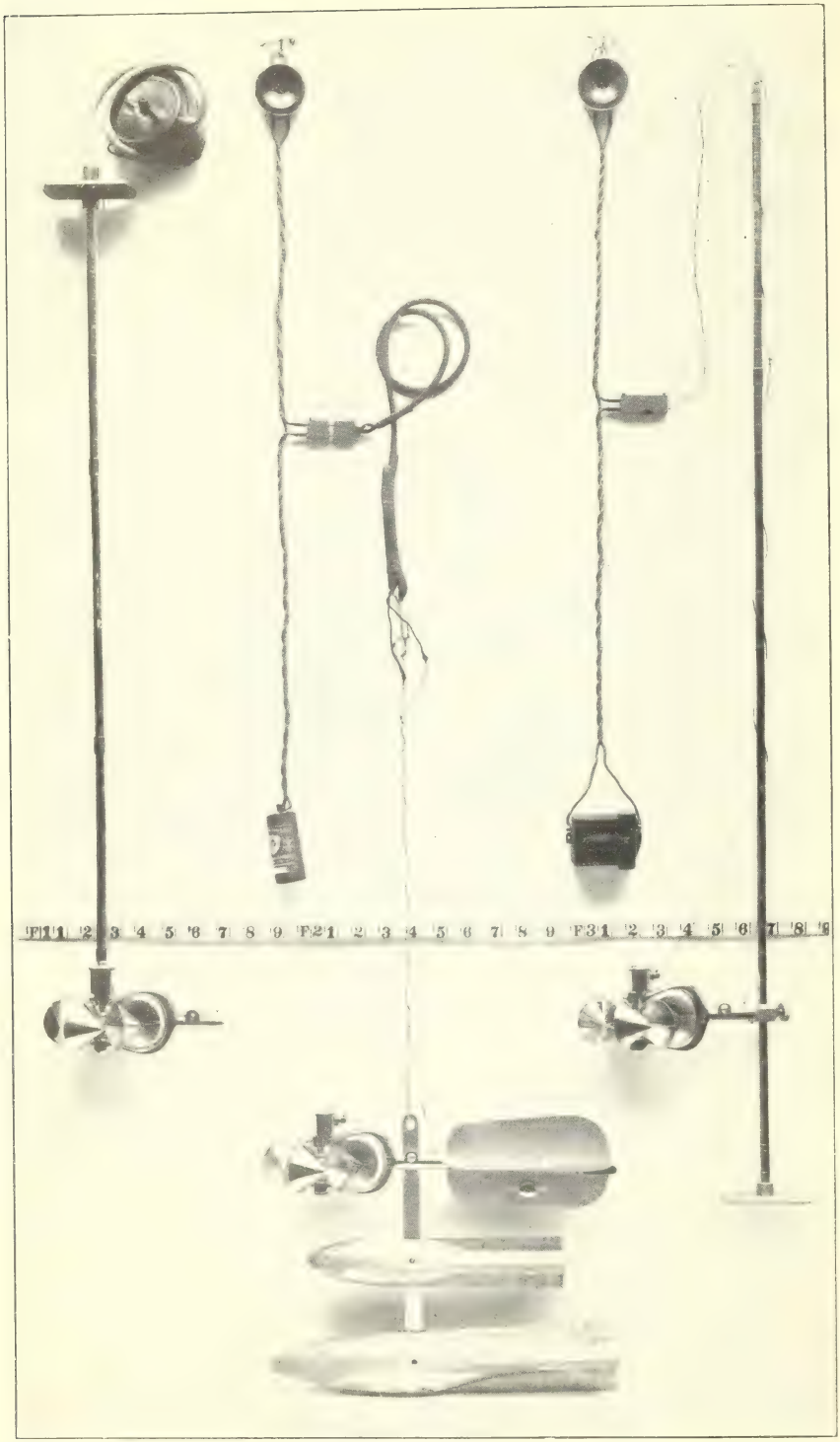
EXPLANATION OF DATA.

For each regular current-meter gaging station the following data, so far as available, are given: Description of the station, list of discharge measurements, table of daily gage heights, table of daily discharge, table of monthly and yearly discharges and run-off. For stations located at weirs or dams the gage-height table is omitted.

A. FOR BRIDGE MEASUREMENT.

B. FOR WADING MEASUREMENT.

TYPICAL GAGING STATIONS.



SMALL PRICE CURRENT METERS.

In addition to statements regarding the location and installation of current-meter stations, the descriptions give information in regard to any conditions which may affect the constancy of the relation of gage height to discharge, covering such points as ice, logging, shifting channels, and backwater; also information regarding diversions which decrease the total flow at the measuring section. Statements are also made regarding the accuracy and reliability of the data.

The table of daily gage heights records the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day, usually in the morning and in the evening. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. All gage heights affected by the presence of ice in the streams or by backwater from obstructions are published as recorded, with suitable footnotes. The rating table is not applicable for such periods unless the proper corrections to the gage heights are known and applied. Attention is called to the fact that the zero of the gage is placed at an arbitrary datum and has no relation to zero flow or the bottom of the river. In general the zero is located somewhat below the lowest known flow, so that negative readings shall not occur.

The discharge measurements and gage heights are the base data from which rating tables, daily discharge tables, and monthly discharge tables are computed.

The rating table gives, either directly or by interpolation, the discharge in second-feet corresponding to every stage of the river recorded during the period for which it is applicable. It is not published in this report but can be determined from the tables of daily gage heights and daily discharge as follows:

First plot the discharge measurements for the current and earlier years on cross-section paper, with gage heights in feet as ordinates and discharge in second-feet as abscissas. Then tabulate a number of gage heights taken from the daily gage-height table for the complete range of stage given and the corresponding discharges for the days selected from the daily discharge table and plot the values on cross-section paper. The last points plotted will define the rating curve used and will lie among the plotted discharge measurements. After drawing the rating curve, a table can be developed by scaling off the discharge in second-feet for each tenth foot of gage height. These values should be so adjusted that the first differences shall always be increasing or constant, except for known backwater periods.

The table of daily discharges gives the discharges in second-feet corresponding to the observed gage heights as determined from the rating tables.

In the table of monthly discharge the column headed "Maximum" gives the mean flow, as determined from the rating table, for the

day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this the computations for the remaining columns, which are defined on pages 8–9, are based.

The field methods used in the collection of the data presented in this series of reports are described in the introductory sections of Water-Supply Papers 261 to 272, inclusive, "Surface water supply of the United States, 1909." Plates I and II show the average precipitation and run-off in the United States, as determined from the measurements of stream flow made by the Geological Survey and records of rainfall collected by the Weather Bureau. Plate III shows typical gaging stations. Plate IV shows current meters[1] used in the work.

ACCURACY AND RELIABILITY OF FIELD DATA AND COMPARATIVE RESULTS.

The accuracy of stream-flow data depends primarily on the natural conditions at the gaging station and on the methods and care with which the data are collected. Errors of the first group depend on the degree of permanency of channel and of permanency of the relation between discharge and stage.

Errors of the second class are due, first, to errors in observation of stage; second, to errors in measurements of flow, and, third, to errors due to misinterpretation of stage and flow data.

In order to give engineers and others information regarding the probable accuracy of the computed results, footnotes are added to the daily discharge tables, stating the probable accuracy of the rating tables used, and an accuracy column is inserted in the monthly discharge table. For the rating tables "well defined" indicates, in general, that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined" or "approximate" within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The accuracy column in the monthly discharge table does not apply to the maximum or minimum nor to any individual day, but to the monthly mean. It is based on the accuracy of the rating, the probable reliability of the observer, and knowledge of local con-

[1] See Hoyt, J. C., and others, Use and care of current meter as practiced by the United States Geological Survey: Trans. Am. Soc. Civil Eng., vol. 66, 1910, p. 70.

ditions. In this column A indicates that the mean monthly flow is probably accurate within 5 per cent; B, within 10 per cent; C, within 15 per cent; D, within 25 per cent. Special conditions are covered by footnotes.

Even though the monthly means for any station may represent with a high degree of accuracy the quantity of water flowing past the gage, the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors which result from including in the measured drainage area large noncontributing districts or omitting estimates of water diverted for irrigation or other use, and they should therefore be considered as only approximate, particularly for periods of irrigation or of low water. For these errors it is as a rule not feasible to make adequate correction.

In general, the base data collected each year by the Survey engineers are published, not only to comply with the law, but to afford any engineer the means of examining and adjusting to his own needs the results of the computations. The table of monthly discharge is so arranged as to give only a general idea of the flow at the station and should not be used for other than preliminary estimates. The determinations of daily discharge allow more detailed studies of the variation in flow by which the period of deficiency may be determined.

It should be borne in mind that the observations in each succeeding year may be expected to throw new light on data already collected and published, and the engineer who makes use of the figures presented in these papers should verify all ratings and make such adjustments for earlier years as may seem necessary.

COOPERATION AND ACKNOWLEDGMENTS.

LAKE SUPERIOR DRAINAGE BASIN.

The work in Minnesota during 1911 has been done with State cooperation under the terms of an act of the legislature of 1909, as embodied in joint resolution 19, which reads as follows:

Whereas the water supplies, water powers, navigation of our rivers, drainage of our lands, and the sanitary condition of our streams and their watersheds generally form one great asset and present one great problem: Therefore, be it resolved by the House of Representatives, the Senate concurring, That the State Drainage Commission be, and is hereby, directed to investigate progress in other States toward the solution of said problem in such States, to investigate and determine the nature of said problem in this State.

The work has been carried on in conjunction with the State Drainage Commission, George A. Ralph, chief engineer.

Special acknowledgment is due to the Great Northern Power Co. for records on the St. Louis River near Thompson, Minn., and for records of discharge of various storage reservoirs in the St. Louis basin.

LAKE MICHIGAN, LAKE HURON, AND LAKE ERIE DRAINAGE BASINS.

Assistance has been rendered or records furnished by the following, to whom special acknowledgment is due: State Geological Survey of Michigan; L. W. Anderson, city engineer, Grand Rapids, Mich.; Eastern Michigan Edison Co., Ann Arbor, Mich.; D. W. Mead, Madison, Wis.; Gardner S. Williams, Ann Arbor, Mich.; William G. Fargo, Jackson, Mich.

LAKE ONTARIO AND ST. LAWRENCE RIVER DRAINAGE BASINS IN NEW YORK.

Cooperation with the State water supply commission of New York was made possible by the provisions of the "Fuller bill," chapter 569, laws of 1907, and carried on under agreements between the State water supply commission and the United States Geological Survey.

New York State cooperation, under the direction of the State engineer and surveyor, has been carried on by cooperative agreements authorized by an act of the State legislature, being paragraph 11 of chapter 420, laws of 1900.

Assistance has been rendered or records furnished by the following, to whom special acknowledgment is due: United States Engineer Corps; John A. Bensel, State engineer and surveyor; Alex. E. Kastl, special deputy State engineer, representing New York State cooperation; State Water Supply Commission of New York, Henry H. Persons, president; and State of New York Conservation Commission, George E. van Kennen, chairman; E. A. Fisher, city engineer and board of park commissioners, Rochester; Plattsburg Gas & Electric Co., Plattsburg.

ST. LAWRENCE RIVER DRAINAGE BASIN IN VERMONT.

The work in Vermont during 1911 has been done in cooperation with the State of Vermont, John A. Mead, governor.

Assistance has been rendered or records furnished by the following, to whom special acknowledgment is due: Newport Electric Light Co.; Prof. C. S. Carleton, of Norwich University; Lane Manufacturing Co.; Colton Manufacturing Co.; Corry, Deavitt & Frost Electric Co.; Sweat-Comings Manufacturing Co.

DIVISION OF WORK.

The field data in the Lake Superior drainage basin were collected under the direction of Robert Follansbee and W. G. Hoyt, district engineers, by C. R. Adams and S. B. Soulé.

The field data in the Lake Michigan, Lake Huron, and Lake Erie drainage basins were collected under the direction of A. H. Horton, district engineer, by cooperating parties.

The field data in the St. Lawrence drainage basin in New York and Vermont were collected under the direction of C. C. Covert by W. G. Hoyt, G. H. Canfield, F. J. Shuttleworth, C. S. de Golyer, and Frank Weber.

The ratings, special estimates, and studies of the completed data were made by A. H. Horton, R. Follansbee, W. G. Hoyt, C. C. Covert, R. H. Bolster, and J. G. Mathers. The computations and preparation of the data for publication were made under the direction of R. H. Bolster by W. G. Hoyt, J. G. Mathers, H. J. Dean, A. H. Tuttle, M. I. Walters, Alexander McMillan, Octave de Carre, G. H. Canfield, C. S. de Golyer, and Frank Weber.

STREAMS TRIBUTARY TO LAKE SUPERIOR.

BRULE RIVER AT MOUTH, MINNESOTA.

Location.—About 300 feet above the steel highway bridge and about 1,700 feet above the mouth of the river.

Records available.—May 5 to October 28, 1911.

Drainage area.—282 square miles.

Gage.—Staff, installed August 2 and read semiweekly by a forest ranger; daily readings impracticable.

Channel.—The channel above the gage is permanent.

Discharge measurements.—At low stages measurements are made by wading medium and high stage measurements are made from a highway bridge.

Accuracy.—Relation between gage height and discharge is affected by wash from the lake which extends to the control point.

Discharge measurements of Brule River at mouth, Minnesota, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 5 [a]	Follansbee and Hawley	1.47	527
June 21 [b]	Hawley and Rosing	.48	82.2
Aug. 2 [b]	Smith and Godin	.57	105
Oct. 2 [b]	S. B. Soulé	.35	62.1

[a] Made at bridge. [b] Made by wading.

Daily gage height, in feet, of Brule River at mouth, Minnesota, for 1911.

[Hans Kasper, observer.]

May	5	1.47
June	21	.48
Aug.	2	.57
	10	.58
	15	.75
Sept.	19	1.32
	23	1.45
	27	1.60
Oct.	2	.35
	7	.35
	8	.35
	16	.38
	20	.38
	28	.38

DEVIL TRACK RIVER AT MOUTH, MINNESOTA.

Location.—At a highway bridge about 200 feet above the mouth of the river.

Records available.—May 5 to October 2, 1911.

Drainage area.—75 square miles.

Gage.—Staff, installed August 3 and read semiweekly by a forest ranger; daily readings impracticable.

Channel.—The channel of the river above the gage is permanent.

Discharge measurements.—Low-stage measurements are made by wading; at high and medium stages measurements are made from the highway bridge.

Accuracy.—Relation between gage height and discharge affected by wash from the lake which extends to the control point.

Discharge measurements of Devil Track River at mouth, Minnesota, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 5	Follansbee and Hawley	0.69	96.3
July 3[a]	Hawley and Smith	−.35	10.9
Aug. 3	C. L. Smith	.40	43.2
Oct. 2	S. B. Soulé	.90	96.7

[a] Dam closed.

NOTE.—Measurements made by wading.

Daily gage height, in feet, of Devil Track River at mouth, Minnesota, for 1911.

[Hans Kasper, observer.]

May	5	0.69
July	3	−.35
Aug.	3	.40
	10	.40
	14	.85
Sept.	19	1.10
	27	1.08
Oct.	2	.90

CASCADE RIVER AT MOUTH, MINNESOTA.

Location.—About 50 feet below the two-span wooden highway bridge, 150 feet above the mouth of the river.

Records available.—May 5 to October 5, 1911.

Drainage area.—84 square miles.

Gage.—Staff fastened to a wharf on the right side of the river 50 feet below the highway bridge.

Channel.—Fairly permanent.

Discharge measurements.—At low stages made by wading about 50 feet below the gage; at high and medium stages from the highway bridge.

Accuracy.—Relation between gage height and discharge affected by backwater from a bar at the mouth of the river.

Discharge measurements of Cascade River at mouth, Minnesota, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 6[a]	Follansbee and Hawley	13.40	329
June 28[b]	W. W. Hawley	13.40	61.6
Aug. 4[b]	Smith and Godin	14.10	45.6
Oct. 5[a]	S. B. Soulé	14.35	109

[a] Measurement made from highway bridge. [b] Measurement made by wading below bridge.

Daily gage height, in feet, of Cascade River at mouth, Minnesota, for 1911.

[J. D. Foley, observer.]

Day.	May.	June.	Day.	May.	June.	Day.	May.	June.
1		13.5	11	13.8		21	13.75	
2		13.5	12	13.83		22	13.8	
3		13.6	13	13.7		23	13.7	
4			14	13.7		24	13.65	
5			15	13.65		25	13.6	
6	13.4		16	13.75		26	13.5	
7	13.5		17	13.8		27	13.55	
8	13.55		18	13.75		28	13.5	
9	13.7		19	13.75		29	13.5	
10	13.65		20	13.7		30	13.55	
						31	13.5	

POPLAR RIVER AT MOUTH, MINNESOTA.

Location.—About 200 feet above the mouth of the river.

Records available.—May 6 to November 4, 1911.

Drainage area.—144 square miles.

Gage.—A staff, reading from 12 to 15 feet, fastened to a stump on the right bank.

Channel.—Divided into three parts by two islands; bed rocky, containing coarse sand and small bowlders.

Discharge measurements.—At low stages made by wading just above the mouth of the river; high-stage measurements will be made from a cable (not yet installed).

Artificial control.—The flow of the river is controlled to some extent by two dams, the nearest being the dam of the National Power & Paper Co., 2½ miles above the station.

Accuracy.—Relation between gage height and discharge at times affected by backwater from a deposit of gravel which is washed up into the mouth of the river during storms on Lake Superior.

Discharge measurements of Poplar River at mouth, Minnesota, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 6	Follansbee and Hawley	12.75	142
July 3	Hawley and Smith	12.37	[a] 61.5
Aug. 4	Smith and Godin	12.53	[a] 65.4
Oct. 5	S. B. Soulé	12.94	82.6

[a] Logging dam closed.

NOTE.—Measurements made by wading at various sections.

Daily gage height, in feet, of Poplar River at mouth, Minnesota, for 1911.

[C. A. A. Nelson, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		12.70	12.00	12.60	12.80	13.38	12.90	16	13.00	12.15	12.05	12.52	13.00	12.82	
2		12.68	12.60	12.60	12.72	13.38	13.40	17	13.12	12.08	12.05	12.48	13.10	12.92	
3		12.65	12.35	12.55	12.70	13.28	13.50	18	13.12	12.65	12.10	12.42	13.05	12.98	
4		12.60	12.20	12.50	12.70	13.15	13.60	19	13.05	13.15	12.15	12.38	13.00	12.98	
5		12.60	12.20	12.50	12.72	13.02		20	13.02	12.05	12.18	12.32	13.00	12.90	
6	12.75	12.58	11.95	12.50	13.05	12.92		21	12.98	12.90	12.20	12.35	12.95	12.82	
7	12.70	12.55	11.70	12.52	13.25	12.82		22	12.92	12.22	12.30	12.40	12.90	12.78	
8	12.70	12.55	11.88	12.60	13.08	12.92		23	12.92	12.60	12.95	12.45	12.98	12.80	
9	12.70	12.50	11.98	12.68	12.92	12.95		24	12.90	12.20	12.70	12.40	13.08	12.80	
10	12.75	13.05	12.05	12.60	12.90	12.90		25	12.88	12.00	12.60	12.55	13.18	12.80	
11	12.88	13.18	12.10	12.55	12.85	12.88		26	12.82	12.00	12.60	12.75	13.12	12.80	
12	12.95	13.08	12.02	12.50	12.82	12.85		27	12.75	12.00	12.52	12.90	13.08	12.78	
13	12.90	12.70	11.05	12.50	12.80	12.80		28	12.75	12.02	12.48	12.92	13.05	12.75	
14	12.85	12.90	11.05	12.48	12.75	12.75		29	12.68	12.50	12.40	13.00	13.15	12.70	
15	12.85	12.55	12.00	12.50	12.92	12.70		30	12.62	12.55	12.40	12.92	13.30	12.70	
								31	12.70		12.52	12.88		12.70	

BEAVER BAY RIVER AT BEAVER BAY, MINN.

Location.—At the highway bridge 600 feet above the mouth of the river.

Records available.—July 26 to December 31, 1911.

Drainage area.—120 square miles.

Gage.—Staff, reading from 0 to 5 feet, attached to the vertical rock wall on the left bank directly beneath the bridge; datum unchanged.

Channel.—Permanent; one at all stages; bed composed of solid rock; banks high and rocky.

Discharge measurements.—Made from a boat or by wading.

Winter flow.—Relation between gage height and discharge little if any affected by ice, as the stream rarely freezes at the rapids.

Accuracy.—The only temporary change in conditions would be caused by logs or drift lodging on the rapids below the gage. Records are believed to be good.

Discharge measurements of Beaver Bay River at Beaver Bay, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 8[a]	Follansbee and Hawley	.....	81.7
July 26[a]	.....do	1.78	62.4
Aug. 6	Smith and Godin	2.00	87.4
Oct. 7	S. B. Soulé	2.42	176
Dec. 8[b]	.....do	1.18	29.4
8[b]	.....do	1.17	27.2

[a] Measurement made from boat. [b] River partly frozen over.

Daily gage height, in feet, of Beaver Bay River at Beaver Bay, Minn., for 1911.

[Louis Lorntson, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.2	1.6	2.4	1.55	.....	16	.....	1.65	2.3	2.05	2.4	.....
2	.....	3.1	1.2	2.25	1.45	.....	17	.....	1.5	2.1	2.8	.....	.....
3	.....	2.7	1.1	2.3	1.35	.....	18	.....	1.45	1.95	2.7	.....	1.48
4	.....	2.3	1.6	2.85	1.2	1.25	19	.....	1.35	2.0	2.4	.....	.....
5	.....	2.05	4.65	2.7	1.2	.....	20	.....	1.25	2.0	2.2	1.7	.....
6	.....	1.85	4.6	2.55	1.45	.....	21	.....	1.35	2.0	2.0	.....	1.35
7	.....	3.1	4.2	2.35	1.65	.....	22	.....	1.5	2.05	2.0	.....	.....
8	.....	3.4	3.7	2.2	1.65	1.2	23	.....	1.4	2.0	2.0	1.7	.....
9	.....	3.2	3.2	2.1	2.0	.....	24	.....	1.25	1.9	1.9	.....	.....
10	.....	3.1	2.95	1.95	2.4	.....	25	.....	1.2	1.8	1.85	.....	.....
11	.....	2.95	2.95	1.9	2.25	1.7	26	1.75	1.1	1.8	1.75	.....	1.25
12	.....	2.65	2.75	1.85	1.95	.....	27	1.4	1.1	1.9	1.75	1.4	.....
13	.....	2.15	2.45	1.8	2.25	.....	28	1.58	1.05	2.1	1.75	.....	1.2
14	.....	1.9	2.3	1.8	2.25	1.65	29	2.05	1.0	2.65	1.6	.....	.....
15	.....	1.8	2.5	1.75	2.3	.....	30	1.85	1.05	2.6	1.55	1.3	.....
							31	1.8	1.4	.....	1.6	.....	.....

NOTE.—Ice started to form in the river Oct. 27 and was present the rest of the year.

ST. LOUIS RIVER AND TRIBUTARIES.

ST. LOUIS RIVER NEAR THOMSON, MINN.

Location.—Just below the tailrace of the Great Northern power house, 3 miles east of Thomson, in sec. 11, T. 48 N., R. 16 W.

Records available.—October 5, 1909, to December 31, 1911.

Drainage area.—3,420 square miles.

Gage.—Chain; datum unchanged; read 4 times each day—at 8 and 11 a. m., 2 and 5 p. m.; average of the 4 readings taken as the mean for the day.

Channel.—Permanent.

Discharge measurements.—Made from a car and cable 1,500 feet below the staff gage.

Artificial control.—The flow at the station is to a certain extent regulated by reservoirs above. The dam at Thomson is designed to hold 24 hours' supply of water for the power plant, and logging dams control the discharge from a large part of the entire area above the station. The gage heights show considerable fluctuations caused by opening and shutting the turbine gates at the power plant. As the plant is operated on a 24-hour schedule, though with varying load, the fluctuations at the gage are not so great as they would be if the turbines were closed part of the time.

Winter flow.—Previous to November, 1910, gage heights at this station were not affected by ice, but the stage at that time was extremely low and the water froze, making gage heights useless as indications of discharge. During the winter of 1910–11 the daily discharge was determined from the power company's record of water passing the turbines; no flow over the spillway during the period.

Accuracy.—The station affords excellent conditions for determinations of discharge, and the records should be good; errors are possible in the record of the mean gage height for the day.

Cooperation.—Gage heights are furnished through the courtesy of the Great Northern Power Co.

Discharge measurements of St. Louis River near Thomson, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 15	C. R. Adams	4.40	6,590
Aug. 31	S. B. Soulé	1.82	1,760

Daily gage height, in feet, of St. Louis River near Thomson, Minn., for 1911.

[Floyd Williams, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.41	2.69	2.59	2.04	3.51	2.18	.....
2	.....	.....	3.13	3.71	.....	3.39	2.58	.....
3	.....	2.20	2.62	3.15	1.39	3.38	.....	2.24
4	.....	2.08	2.46	.....	.....	3.23	.....	2.25
5	.....	1.72	2.26	2.70	1.06	3.10	1.87	2.24
6	.....	1.57	3.03	3.24	1.06	3.09	3.26	2.10
7	.....	1.34	.....	3.14	1.37	3.02	3.80	.....
8	.....	1.52	2.02	2.62	2.50	3.15	5.26	2.23
9	.....	.....	1.91	2.26	2.28	3.85	5.26	1.88
10	0.26	1.49	2.22	2.35	.....	3.87	.....	1.85
11	.34	1.66	2.62	2.26	1.28	3.86	4.71	1.79
12	.....	2.14	2.02	2.39	.73	4.39	4.63	1.97
13	.43	3.62	1.92	2.50	.57	.....	4.73	1.66
14	.53	4.45	.....	3.08	.48	4.38	.....	1.84
15	.44	4.36	1.90	3.48	.47	3.82	4.16	1.82
16	.75	.....	3.25	3.92	.....	3.46	4.16	2.06
17	.82	4.03	4.86	3.20	.41	3.42	4.15	2.36
18	.79	4.04	5.78	.....	.37	2.80	4.14	1.76
19	.90	3.96	5.29	2.88	.21	2.48	4.02	1.74
20	.88	4.12	5.55	2.24	.07	.....	3.59	2.00
21	.91	3.97	.....	1.91	.03	2.42	2.82	2.17
22	.98	4.01	4.88	1.91	.....	2.12	2.48	.....
23	1.02	4.28	4.78	1.52	.19	2.46	2.41	2.19
24	1.05	4.28	4.27	1.18	.57	2.48	2.52	1.59
25	1.32	4.32	4.26	.....	.99	2.49	2.07	1.37
26	.....	4.12	3.80	2.34	1.25	.....	1.89	1.77
27	1.52	3.81	4.24	1.84	1.24	.....	1.78	1.78
28	1.89	3.61	2.82	2.02	1.64	2.40	2.01	1.72
29	2.16	3.12	2.48	2.25	1.89	1.98	2.22	1.64
30	2.35	.....	1.70	2.33	1.52	1.83	2.35	1.54
31	2.48	.....	2.35	.....	1.87	1.90	.....	1.55

NOTE.—Ice present Jan. 1 to Mar. 9 and Nov. 1 to Dec. 31.

Daily discharge, in second-feet, of St. Louis River near Thomson, Minn., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	259	316	340	2,490	2,870	2,730	2,020	4,200	2,200	2,350	1,160	583
2	278	301	344	2,350	3,540	4,610	1,660	3,990	2,720	2,300	992	578
3	261	302	322	2,220	2,770	3,580	1,300	3,970	2,420	2,270	842	541
4	240	278	318	2,070	2,560	3,130	1,140	3,710	2,120	2,280	783	521
5	213	274	351	1,650	2,300	2,880	984	3,500	1,820	2,270	772	587
6	218	285	349	1,490	3,380	3,730	984	3,480	3,760	2,100	1,060	560
7	228	275	320	1,250	2,690	3,560	1,280	3,370	4,820	2,180	1,020	580
8	192	285	320	1,440	2,000	2,770	2,610	3,580	9,420	2,260	1,020	584
9	205	282	370	1,420	1,870	2,300	2,320	4,940	9,420	1,830	1,090	593
10	247	283	410	1,400	2,240	2,410	1,760	4,990	8,400	1,800	1,070	635
11	236	285	452	1,590	2,770	2,300	1,190	4,960	7,530	1,730	1,100	565
12	231	307	477	2,140	2,000	2,460	702	6,480	7,260	1,940	791	601
13	235	316	503	4,420	1,880	2,610	590	6,460	7,600	1,590	542	496
14	230	308	564	6,680	1,870	3,460	533	6,450	6,700	1,790	685	572
15	223	302	509	6,390	1,860	4,150	527	4,860	5,790	1,760	715	562
16	234	301	718	5,900	3,740	5,120	518	4,110	5,790	2,050	883	586
17	285	306	772	5,420	8,040	3,660	509	4,040	5,760	2,420	893	543
18	292	304	748	5,450	11,200	3,400	468	3,030	5,730	1,700	785	536
19	291	316	840	5,230	9,530	3,150	385	2,580	5,390	1,670	796	601
20	309	318	823	5,670	10,400	2,270	316	2,540	4,360	1,980	709	559
21	290	342	849	5,250	9,250	1,870	298	2,500	3,060	2,180	754	557
22	291	332	912	5,360	8,110	1,870	285	2,120	2,580	2,200	711	674
23	304	362	948	6,140	7,770	1,440	375	2,560	2,490	2,210	692	708
24	284	379	975	6,140	6,120	1,100	590	2,580	2,640	1,510	633	810
25	296	367	1,230	6,270	6,080	1,780	921	2,600	2,060	1,280	706	597
26	287	338	1,340	5,670	4,820	2,400	1,160	2,560	1,840	1,710	946	518
27	322	362	1,440	4,840	6,020	1,790	1,150	2,520	1,720	1,720	768	488
28	318	337	1,840	4,400	3,060	2,000	1,560	2,480	1,990	1,650	763	444
29	303	.....	2,170	3,530	2,580	2,280	1,840	1,950	2,240	1,560	777	515
30	317	.....	2,410	3,200	1,630	2,380	1,440	1,770	2,410	1,460	800	447
31	308	.....	2,580	.....	2,410	.....	1,820	1,860	.....	1,470	.....	459

NOTE.—Daily discharge Jan. 1 to Mar. 8 and Nov. 1 to Dec. 31 determined from records of flow through the turbines. Daily discharge Mar. 10 to Oct. 30 determined from a discharge rating curve, well defined between 600 and 7,000 second-feet. Discharge interpolated for days for which no gage heights are available,

Monthly discharge of St. Louis River near Thomson, Minn., for 1911.

[Drainage area, 3,420 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	322	192	265	0.077	0.09	A.
February	379	274	313	.092	.10	A.
March	2,580	318	856	.250	.29	B.
April	6,680	1,250	3,920	1.15	1.28	A.
May	11,200	1,630	4,430	1.30	1.50	A.
June	5,120	1,100	2,770	.810	.90	A.
July	2,610	285	1,070	.313	.36	B.
August	6,480	1,770	3,570	1.04	1.20	A.
September	9,420	1,720	4,400	1.29	1.44	A.
October	2,420	1,460	1,910	.558	.64	A.
November	1,160	542	839	.245	.27	A.
December	810	444	568	.166	.19	A.
The year	11,200	192	2,080	.608	8.26	

WHITEFACE RIVER AT MEADOWLANDS, MINN.

Location.—At the highway bridge at Meadowlands, in sec. 14, T. 53 N., R. 19 W., half a mile below the nearest tributary, a very small stream entering from the east.

Records available.—June 7, 1909, to December 31, 1911.

Drainage area.—442 square miles.

Gage.—Vertical staff; datum unchanged.

Channel.—Shifting during high water.

Discharge measurements.—Made from the highway bridge except during low stages, when measurements are made by wading.

Artificial control.—The flow is controlled to a large extent by logging dams above. The operation of the gates of these dams causes fluctuations in gage height amounting to several feet at the gaging station.

Accuracy.—On account of the shifting character of the channel the discharge has been computed from a number of rating curves, some of which have been applied indirectly. The records can not be considered better than fair. The records of extreme stage are of little value.

Discharge measurements of Whiteface River at Meadowlands, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 26	Robt. Follansbee	5.94	325
May 19	C. J. Emerson	9.59	1,820
June 5	Follansbee and Soulé	5.42	304
July 27	S. B. Soulé	5.63	519
28	do	4.24	156
Sept. 29	do	5.22	373

Daily gage height, in feet, of Whiteface River at Meadowlands, Minn., for 1911.

[A. F. Johnson, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	7.40	4.85	5.20	7.45	6.05	5.15	4.50
2	.....	5.90	6.25	4.70	5.65	5.20	5.12	4.50
3	.....	5.00	7.50	6.05	4.95	4.95	5.00	4.40
4	.....	4.95	6.65	5.25	6.45	5.10	5.00	4.35
5	.....	6.30	5.45	4.70	5.85	7.55	5.00	4.25
6	.....	4.20	6.65	4.80	6.85	8.75	4.90	4.20
7	.....	4.10	7.65	4.70	8.20	8.80	4.90	4.20
8	.....	5.80	7.25	4.15	8.65	8.40	4.90	4.20
9	.....	7.70	6.15	3.85	7.15	8.70	4.82	4.20
10	.....	5.65	6.50	3.80	5.60	7.70	4.80	4.20
11	.....	3.90	6.80	3.45	6.55	7.05	4.86	4.10
12	6.35	4.70	7.35	3.40	7.35	6.95	5.20	4.10
13	7.35	4.70	7.85	3.40	7.40	6.40	5.35	.....
14	7.80	5.20	6.45	3.40	6.55	5.90	5.30	.....
15	7.45	5.80	5.20	3.40	5.50	6.20	5.30	.....
16	8.10	9.10	7.05	3.40	5.15	6.10	6.40	.....
17	8.35	10.63	7.88	3.40	6.50	5.80	5.18	.....
18	7.95	10.67	7.55	3.32	7.40	6.10	4.90	.....
19	7.85	9.93	5.85	3.35	6.50	6.30	4.85	.....
20	6.40	10.77	5.75	3.40	5.55	6.05	4.80	.....
21	7.05	10.13	6.00	3.40	5.10	5.80	4.80	.....
22	7.20	9.27	5.85	3.40	5.45	5.95	4.70	.....
23	7.80	8.60	6.55	3.40	5.18	6.05	4.70	.....
24	7.30	7.07	5.80	3.40	6.08	5.60	4.70	.....
25	6.90	6.78	4.65	3.75	5.45	5.25	4.80	.....
26	5.95	6.48	4.70	4.85	4.95	5.00	4.80	.....
27	5.85	6.25	6.40	5.60	4.80	4.90	4.70	.....
28	6.05	5.65	5.00	4.50	4.70	4.70	4.70	.....
29	7.00	5.45	6.05	4.80	5.50	5.10	4.60	.....
30	7.60	5.15	5.25	5.45	6.95	5.25	4.60	.....
31	.....	4.90	.....	6.10	7.15	.....	4.50	.....

NOTE.—Ice present January to Apr. 11 and from early in November to Dec. 31.

Daily discharge, in second-feet, of Whiteface River at Meadowlands, Minn., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	880	195	345	1,120	608	352	215
2	.....	320	515	240	485	365	345	215
3	.....	140	945	590	305	305	315	200
4	.....	125	650	355	748	340	315	192
5	.....	440	310	240	545	1,160	315	178
6	.....	80	650	285	888	1,640	295	170
7	.....	75	1,000	265	1,420	1,660	295	170
8	.....	295	890	160	1,600	1,500	295	170
9	.....	970	530	115	1,000	1,620	279	170
10	.....	255	640	110	470	1,220	275	170
11	.....	70	735	65	782	960	275	155
12	455	100	930	60	1,080	922	365	155
13	821	100	1,130	60	1,100	730	402	.....
14	1,010	170	620	60	782	560	390	.....
15	862	295	295	60	440	660	390	.....
16	1,140	1,600	875	60	352	625	730	.....
17	1,240	2,310	1,200	60	765	530	360	.....
18	1,080	2,330	1,060	60	1,100	625	295	.....
19	1,030	1,980	485	65	765	695	285	.....
20	475	2,370	445	65	455	608	275	.....
21	725	2,070	515	70	340	530	275	.....
22	760	1,690	475	70	428	575	255	.....
23	1,010	1,390	680	70	360	608	255	.....
24	805	795	460	70	618	470	255	.....
25	645	695	205	120	428	378	275	.....
26	325	590	245	320	305	315	275	.....
27	305	530	690	515	275	295	255	.....
28	365	360	310	215	255	255	255	.....
29	680	310	590	275	440	340	235	.....
30	920	250	360	428	922	378	235	.....
31	.....	200	.....	625	1,000	.....	215	.....

NOTE.—Daily discharge determined from a fairly well-defined discharge rating curve; curve applied indirectly prior to Aug. 1, as channel was obstructed.

Monthly discharge of Whiteface River at Meadowlands, Minn., for 1911.

[Drainage area, 442 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
April 12-30	1,240	305	771	1.74	1.23	C.
May	2,370	70	767	1.74	2.01	C.
June	1,200	195	621	1.40	1.56	C.
July	625	60	197	.446	.51	C.
August	1,600	255	696	1.57	1.81	B.
September	1,660	255	716	1.62	1.81	B.
October	730	215	311	.704	.81	B.
November 1-12	215	155	180	.407	.18	B.

CLOQUET RIVER AT INDEPENDENCE, MINN.

Location.—At the highway bridge at Independence post office, in sec. 26, T. 52 N., R. 17 W., just below a small tributary entering from the north.

Records available.—June 28, 1909, to December 31, 1911.

Drainage area.—698 square miles.

Gage.—Vertical staff; datum unchanged since establishment.

Channel.—Permanent; relation of gage height to discharge affected by log jams.

Discharge measurements.—Made from the bridge.

Artificial control.—Cloquet River is used extensively for log driving, and the run-off from by far the greater part of the drainage area above Independence is controlled

by logging dams. This control causes violent fluctuations in the gage height during the day, amounting at times to several feet, and consequently the mean daily gage height for the days when the dam is in use—which is the mean of three readings taken morning, noon, and night—can be considered only approximate. During the open season of 1911 a wing dam of logs, placed at the rapids just below the bridge for the purpose of aiding the log drive, caused backwater at the gage. The amount of this backwater was lessened at low stages, as the wing dam rested on the rocks between which a large part of the water flowed. This wing dam was practically permanent, and as the effect at different stages was determined by discharge measurements the accuracy of estimates is not materially affected.

Winter flow.—Prior to the later part of 1911 observations have been discontinued during the winter on account of ice; monthly mean flow computed from the records of flow at the Island Lake logging dam on the Cloquet and the discharge of Wild Rice Lake on Beaver River.

Cooperation.—Records at Island Lake dam and Wild Rice Lake furnished by the Great Northern Power Co.

Discharge measurements of Cloquet River at Independence, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 21	C. J. Emerson	8.28	2,240
June 6	Follansbee and Soulé	7.36	1,510
July 28[a]	S. B. Soulé	4.30	98
Sept. 30	.....do	6.28	734
Dec. 10[b]	.....do	4.74	43

[a] Measurement made by wading. [b] Measurement made under complete ice cover.

Daily gage height, in feet, of Cloquet River at Independence, Minn., for 1911.

[Fred Haakensen and Herbert Haakensen, observers.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	6.67	9.58	4.28	8.08	7.10	6.04	5.02	.....
2	.....	5.53	6.93	4.20	7.17	5.28	6.34	4.90	.....
3	.....	4.80	5.28	4.12	6.44	4.95	6.01	4.76	.....
4	.....	4.52	5.12	4.12	6.13	4.60	6.62	5.20	4.00
5	.....	4.38	7.06	4.11	5.98	5.98	6.21	5.77	.....
6	.....	4.30	7.39	6.06	5.95	5.53	6.44	5.95	.....
7	.....	4.26	5.33	8.19	6.02	7.03	6.03	5.88	4.00
8	.....	4.28	4.77	7.70	6.02	7.27	6.12	5.72	.....
9	.....	5.62	4.56	6.62	5.65	6.40	5.93	5.72	.....
10	.....	6.09	4.52	4.85	4.94	6.93	6.62	5.81	4.74
11	.....	4.87	4.94	4.39	4.80	8.07	5.85	5.85	3.90
12	.....	4.58	4.75	4.23	4.74	7.88	5.78	5.14	.....
13	.....	4.54	6.68	4.10	4.68	7.36	6.35	4.50	.....
14	.....	4.55	5.97	4.08	4.67	7.61	5.54	.....	3.00
15	.....	6.83	8.53	4.02	5.29	7.27	5.68	.....	.....
16	.....	6.39	7.56	4.01	5.55	7.75	6.54	4.65	.....
17	.....	7.22	7.24	3.98	4.85	8.21	6.26	.....	.....
18	.....	6.68	7.66	3.94	4.63	8.04	5.81	.....	3.95
19	.....	6.84	5.32	3.92	4.52	8.09	6.44	.....	.....
20	5.66	8.75	4.68	3.90	4.47	6.26	6.54	4.50	.....
21	5.20	8.09	4.43	3.90	4.63	4.98	6.58	.....	3.20
22	6.06	8.53	4.26	3.90	4.77	4.76	6.24	.....	.....
23	7.05	7.53	4.15	4.15	4.80	4.61	4.90	4.50	.....
24	7.51	7.82	5.53	4.33	4.83	4.58	5.37	.....	.....
25	7.29	7.74	7.49	4.39	4.72	4.56	5.14	.....	.....
26	7.14	8.62	5.55	4.33	4.61	4.56	4.80	.....	.....
27	7.11	7.78	4.79	4.19	5.68	5.55	4.88	4.00	.....
28	5.59	5.64	4.69	4.29	5.78	6.55	5.59	.....	3.78
29	4.85	4.94	4.50	4.29	4.93	6.29	6.26	.....	.....
30	4.66	5.82	4.35	4.28	4.63	6.31	6.15	4.00	.....
31	.....	5.16	.....	8.71	5.68	.....	6.31	.....	.....

NOTE.—Ice present Jan. 1 to Apr. 19 and from Nov. 13 to Dec. 31. On June 5 a log wing dam was constructed just below the gaging station, which changed the control for the remainder of the year.

Daily discharge, in second-feet, of Cloquet River at Independence, Minn., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1,560	6,010	88	2,070	1,300	608	235
2	.....	612	1,890	78	1,350	311	764	204
3	.....	277	480	70	826	217	594	171
4	.....	191	402	70	650	138	944	286
5	.....	156	1,260	69	581	581	690	490
6	.....	138	1,520	617	568	396	826	568
7	.....	130	327	2,160	599	1,240	604	536
8	.....	134	173	1,770	599	1,430	645	469
9	.....	662	131	944	442	800	558	469
10	.....	992	124	192	214	1,170	944	506
11	.....	302	214	103	180	2,070	524	524
12	.....	207	169	82	167	1,910	494	269
13	.....	196	986	68	154	1,500	770	.....
14	.....	199	576	66	152	1,700	400	.....
15	.....	1,760	2,430	62	314	1,430	453	.....
16	.....	1,260	1,660	61	404	1,810	891	.....
17	.....	2,280	1,400	59	192	2,180	718	.....
18	.....	1,580	1,740	56	144	2,040	506	.....
19	.....	1,770	324	55	124	2,080	826	.....
20	686	4,630	154	54	115	718	891	.....
21	440	3,570	109	54	144	225	917	.....
22	968	4,280	85	54	173	171	707	.....
23	2,040	2,710	73	73	180	140	204	.....
24	2,680	3,150	396	94	187	134	340	.....
25	2,380	3,030	1,600	103	162	131	269	.....
26	2,170	4,420	404	94	140	131	180	.....
27	2,120	3,090	178	77	453	404	199	.....
28	644	674	156	89	494	898	418	.....
29	294	327	120	89	212	734	718	.....
30	232	789	97	88	144	746	660	.....
31	.....	421	.....	2,580	453	.....	746	.....

NOTE.—Daily discharge computed from two well-defined rating tables, one of which was applied prior to June 5 and the second one beginning that date.

Monthly discharge of Cloquet River at Independence, Minn., for 1911.

[Drainage area, 698 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	[a] 90	0.129	0.15	C.
February	.....	.....	[a] 100	.143	.15	C,
March	.....	.....	[a] 130	.186	.21	C,
April	2,680	232	[b] 800	1.15	1.28	B.
May	4,630	130	1,470	2.11	2.43	B.
June	6,010	73	840	1.20	1.34	B.
July	2,580	54	326	.467	.54	B.
August	2,070	115	406	.582	.67	B.
September	2,180	131	958	1.37	1.53	B.
October	944	180	613	.878	1.01	B.
November	.....	.....	[c] 250	.358	.40	D.
December	.....	.....	[c] 50	.072	.08	D.
The year	.....	.....	504	.722	9.79	

[a] Estimated from records of flow from Island Lake dam and from Wild Rice reservoir, as maintained by the Great Northern Power Co. A small allowance has been made for flow of intervening streams.

[b] Mean discharge Apr. 1–19 estimated at 492 second-feet, from climatologic records and by comparison with records of flow of St. Louis River.

[c] Estimated from climatologic records, one measurement in December and by comparison with records of flow of St. Louis River.

STREAMS TRIBUTARY TO LAKE MICHIGAN.

ESCANABA RIVER NEAR ESCANABA, MICH.

Location.—At highway bridge between Escanaba and Gladstone, Mich., about 9 miles north of Escanaba and 4 miles above mouth of river.

Records available.—August 25, 1903, to March 31, 1909; June 1, 1909, to December 31, 1911. Discharge measurements only April, May, and July, 1903.

Drainage area.—800 square miles.

Gage.—Standard chain attached to bridge; new gage installed November 15, 1910.

Channel.—Probably permanent.

Discharge measurements.—Made from downstream side of bridge.

Winter flow.—Affected by ice which exists some years for nearly 4 months.

Accuracy.—Relation between gage height and discharge, during the logging season, affected by backwater from log jams. All gage readings for 1911 are correct, provided the new chain (installed Nov. 15, 1910) has not stretched, and provided, also, that the structure to which the gage is attached has not changed since July 16, 1908.

Daily gage height, in feet, of Escanaba River near Escanaba, Mich., for 1911.

[Olive Beauchamp, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.9	3.3	.....	4.4	3.3	2.0	4.9	2.6	2.9	2.7	5.0
2	.....	.....	.....	.....	3.6	3.3	2.0	5.7	2.6	2.9	2.7	5.2
3	.....	.....	.....	.....	3.5	2.9	2.1	6.0	2.5	2.8	2.7	4.7
4	2.7	.....	.....	.....	3.4	2.9	2.1	5.7	2.5	2.9	2.6	4.8
5	.....	.....	.....	3.6	3.3	2.9	2.1	5.7	2.6	3.0	2.6	4.7
6	.....	.....	.....	.....	3.2	3.1	2.5	4.0	2.6	3.6	2.6	4.6
7	.....	.....	.....	.....	3.2	2.9	2.6	4.1	2.9	4.4	2.7	4.3
8	.....	2.9	3.3	.....	3.1	2.8	2.5	3.9	3.1	4.4	2.7	4.4
9	.....	.....	.....	.....	2.9	2.6	2.5	4.9	3.0	4.4	3.0	4.5
10	.....	.....	.....	.....	2.8	2.6	2.3	3.9	2.9	4.0	3.0	4.8
11	3.0	.....	.....	3.2	2.7	2.6	2.4	3.8	2.7	3.4	3.1	4.8
12	.....	.....	.....	3.5	2.6	2.6	2.3	3.8	2.7	3.4	3.4	4.9
13	.....	.....	.....	4.8	2.5	2.8	2.2	3.6	2.7	3.3	3.7	4.9
14	.....	.....	.....	4.2	2.5	3.1	2.1	3.4	2.6	3.2	3.6	4.6
15	.....	2.9	3.3	4.5	3.0	3.4	2.1	3.2	2.6	3.1	3.6	3.9
16	.....	.....	.....	6.8	3.1	3.3	2.1	3.1	2.7	3.1	3.4	3.7
17	.....	.....	.....	4.5	3.4	3.4	2.1	3.0	2.7	3.3	3.4	3.5
18	2.9	.....	.....	4.4	3.8	2.6	2.2	2.9	2.6	3.4	3.6	3.4
19	.....	.....	.....	4.8	4.3	2.4	2.1	2.7	2.5	3.5	3.2	3.2
20	.....	.....	.....	5.2	4.4	2.4	2.1	2.7	2.4	3.6	3.0	3.2
21	.....	.....	.....	6.6	4.3	2.3	2.1	2.8	2.4	3.3	3.1	3.2
22	.....	3.3	3.4	4.5	4.2	2.3	2.2	2.9	2.4	3.3	2.9	3.2
23	.....	.....	.....	4.4	4.3	2.5	3.0	2.8	2.4	3.3	2.9	3.0
24	.....	.....	.....	4.3	4.1	2.3	3.2	2.8	2.5	3.2	2.8	3.0
25	2.9	.....	.....	4.4	4.0	2.2	3.2	2.7	2.5	3.2	2.8	3.2
26	.....	.....	.....	4.2	3.9	2.3	3.2	2.6	2.5	3.1	2.8	5.0
27	.....	.....	.....	4.1	3.7	2.3	3.3	2.6	2.5	3.1	2.8	5.0
28	.....	.....	.....	4.0	3.5	2.2	3.5	2.7	2.5	2.9	3.0	6.0
29	.....	.....	4.3	4.2	3.4	2.2	3.6	2.7	2.6	2.9	3.0	5.9
30	.....	.....	.....	4.4	3.3	2.1	3.4	2.6	2.8	2.8	5.0	5.9
31	.....	.....	.....	.....	3.7	.....	3.5	2.6	.....	2.8	.....	5.9

NOTE.—Relation of gage height to discharge affected by ice Jan. 1 to Apr. 10, and probably Nov. 30 to Dec. 31; gage heights during these periods read to water surface. No information regarding ice jams.

Daily discharge, in second-feet, of Escanaba River near Escanaba, Mich., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3,030	,420	300	4,000	710	970	790
2	.....	1,810	1,420	300	5,860	710	970	790
3	.....	1,680	970	350	6,640	630	880	790
4	.....	1,550	970	350	5,860	630	970	710
5	.....	1,420	970	350	5,860	710	1,070	710
6	.....	1,300	1,180	630	2,380	710	1,810	710
7	.....	1,300	970	710	2,530	970	3,030	790
8	.....	1,180	880	630	2,230	1,180	3,030	790
9	.....	970	710	630	2,380	1,070	3,030	1,070
10	.....	880	710	480	2,230	970	2,380	1,070
11	1,300	790	710	550	2,090	790	1,550	1,180
12	1,680	710	710	480	2,090	790	1,550	1,550
13	3,790	630	880	410	1,810	790	1,420	1,950
14	2,690	630	1,180	350	1,550	710	1,300	1,810
15	3,210	1,070	1,550	350	1,300	710	1,180	1,810
16	8,870	1,180	1,420	350	1,180	790	1,180	1,550
17	3,210	1,550	1,550	350	1,070	790	1,420	1,550
18	3,030	2,090	710	410	970	710	1,550	1,810
19	3,790	2,860	550	350	790	630	1,680	1,300
)	4,650	3,030	550	350	790	550	1,810	1,070
21	8,290	2,860	480	350	880	550	1,420	1,180
22	3,210	2,690	480	410	970	550	1,420	970
23	3,030	2,860	630	1,070	880	550	1,420	970
24	2,860	2,530	480	1,300	880	630	1,300	880
25	3,030	2,380	410	1,300	790	630	1,300	880
26	2,690	2,230	480	1,300	710	630	1,180	880
27	2,530	1,950	480	1,420	710	630	1,180	880
28	2,380	1,680	410	1,680	790	630	970	1,070
29	2,690	1,550	410	1,810	790	710	970	1,070
30	3,030	1,420	350	1,550	710	880	880	1,900
31	.....	1,950	.....	1,680	710	.....	880	.....

NOTE.—Daily discharge determined from a discharge rating curve well defined above 300 second-feet.

Monthly discharge of Escanaba River near Escanaba, Mich., for 1911.

[Drainage area, 800 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	275	0.344	0.40	D.
February	.....	.....	300	.375	.39	D.
March	.....	.....	500	.625	.72	D.
April	8,870	.....	2,600	3.25	3.63	C.
May	3,030	630	1,730	2.16	2.49	B.
June	1,550	350	821	1.03	1.15	B.
July	1,810	300	727	.909	1.05	B.
August	6,640	710	2,010	2.51	2.89	B.
September	1,180	550	731	.914	1.02	B.
October	3,030	880	1,470	1.84	2.12	B.
November	1,950	710	1,150	1.44	1.61	B.
December	.....	.....	1,000	1.25	1.44	D.
The year	8,870	.....	1,110	1.39	18.31	

NOTE.—Discharge for periods during which ice was present estimated from climatologic records and by comparison with the record of flow of Menominee River. Mean discharge Apr. 1 to 10 estimated at 800 second-feet.

MENOMINEE RIVER NEAR IRON MOUNTAIN, MICH.

Location.—At the Homestead highway bridge, 3½ miles south of Iron Mountain, Mich.

Records available.—September 4, 1902, to March 31, 1909; June 5, 1909, to December 31, 1911.

Drainage area.—2,420 square miles.

Gage.—Standard chain, attached to the bridge May 18, 1901; the original gage was a staff on the right abutment of the bridge.

Channel.—Probably permanent.

Artificial control.—The flow of the river is to a certain extent controlled by logging dams.

Winter flow.—Affected by ice.

Accuracy.—Relation between gage height and discharge affected by ice for several months each year and also by backwater from log jams that form below the station

Cooperation.—Maintained in 1911 by Oliver Iron Mining Co.

Daily gage height, in feet, of Menominee River near Iron Mountain, Mich., for 1911.

[A. S. St. Arnald, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	3.0	4.4	4.2	5.2	2.6	7.8	2.9	2.5	3.0	3.1
2	1.7	.....	2.7	4.1	3.8	4.3	2.1	7.8	3.1	2.5	3.0	3.0
3	.....	.....	2.7	3.9	2.5	2.9	2.3	8.6	2.7	2.7	2.	3.0
4	.....	.....	2.4	3.4	3.2	4.2	1.8	8.2	2.4	2.7	2.8	2.8
5	.....	2.1	2.4	3.3	2.4	3.8	1.6	7.1	2.1	3.6	2.8	2.7
6	.....	.....	2.4	3.3	2.1	4.3	1.9	5.7	3.0	4.7	2.8	2.5
7	.....	.....	2.4	3.4	2.4	3.6	2.8	5.2	3.4	7.1	2.8	3.0
8	1.9	.....	2.4	3.5	2.9	3.1	2.2	6.6	3.4	7.2	3.0	3.0
9	.....	.....	2.7	3.9	3.2	3.4	2.0	6.6	3.4	6.7	3.0	3.0
10	.....	.....	3.0	3.9	3.6	2.8	1.9	6.5	3.2	6.0	3.2	3.4
11	.....	.....	3.0	3.9	3.9	4.3	1.9	6.0	3.2	5.3	3.2	3.9
12	.....	2.1	3.0	4.8	3.9	2.6	1.8	5.3	2.4	5.3	3.6	4.5
13	.....	.....	2.7	5.7	3.9	2.3	1.6	4.8	2.4	4.7	3.5	4.7
14	.....	.....	3.0	6.6	3.8	2.0	1.6	4.3	2.9	4.2	3.3	4.9
15	1.8	.....	3.0	6.9	2.8	2.2	1.4	3.9	2.9	4.0	3.3	4.7
16	.....	.....	3.0	6.9	2.7	2.6	1.2	3.5	2.9	3.7	3.4	4.4
17	.....	.....	3.0	6.9	3.8	2.1	1.2	3.4	2.6	4.[illegible]	3.3	4.2
18	.....	.....	3.0	6.2	5.7	3.7	1.2	3.4	2.6	4.5	3.2	4.2
19	.....	2.3	3.0	6.2	9.2	1.3	1.3	3.1	2.1	5.7	3.0	4.0
20	.....	2.3	3.0	6.6	11.0	1.4	2.0	2.7	1.9	5.5	3.0	4.0
21	.....	2.3	3.0	6.2	10.8	1.9	1.6	2.3	1.9	5.4	3.2	3.0
22	2.0	2.3	3.0	7.0	10.8	2.7	1.8	3.3	1.4	5.3	3.2	3.0
23	.....	2.3	3.4	7.1	11.3	3.2	1.8	3.[illegible]	1.6	5.3	3.0	3.0
24	.....	2.3	3.6	4.5	10.0	3.5	2.0	3.0	1.8	4.7	3.1	3.0
25	.....	2.5	3.6	5.5	10.0	2.4	2.4	2.8	2.1	4.1	3.1	3.0
26	.....	2.5	3.8	4.9	8.7	1.9	2.7	2.8	1.5	4.0	3.0	3.0
27	.....	2.5	3.8	3.4	8.6	2.1	3.7	3.1	1.7	3.9	3.0	[illegible].0
28	.....	3.0	4.4	5.1	8.9	2.5	3.2	3.1	1.9	3.6	3.[illegible]	3.2
29	2.1	.....	5.0	4.8	7.2	2.1	3.2	2.6	2.0	3.6	3.[illegible]	3.2
30	.....	.....	4.8	4.8	8.1	2.3	3.8	2.6	2.5	3.1	3.1	3.3
31	.....	.....	4.6	.....	6.6	.....	4.4	2.6	.....	3.1	.....	3.3

NOTE.—Relation of gage height to discharge apparently affected by ice Jan. 1 to Mar. 27; gage heights during December assumed unaffected. No information regarding backwater from log jams.

Daily discharge, in second-feet, of Menominee River near Iron Mountain, Mich., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3,260	3,110	3,930	1,940	6,520	2,150	1,880	2,220	2,290
2	.....	3,040	2,810	3,180	1,620	6,520	2,290	1,880	2,220	2,[illegible]20
3	.....	2,880	1,880	2,150	1,756	7,330	2,010	2,010	2,150	2,[illegible]
4	.....	2,510	2,360	3,110	1,440	6,970	1,820	2,010	2,080	2,080
5	.....	2,440	1,820	2,810	1,340	5,760	1,620	2,660	2,080	2,010
6	.....	2,440	1,620	3,180	1,500	4,400	2,220	3,500	2,080	1,[illegible]
7	.....	2,510	1,820	2,660	2,080	3,930	2,510	5,760	2,080	2,220
8	.....	2,580	2,150	2,290	1,680	5,260	2,510	5,860	2,220	2,220
9	.....	2,880	2,360	2,510	1,560	5,260	2,510	5,360	2,220	2,220
10	.....	2,880	2,660	2,080	1,500	5,160	2,360	4,680	2,360	2,510

Daily discharge, in second-feet, of Menominee River near Iron Mountain, Mich., for 1911—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	.....	2,880	2,880	3,180	1,500	4,680	2,360	4,020	2,360	2,880
12	.....	3,580	2,880	1,940	1,440	4,020	1,820	4,020	2,660	3,340
13	.....	4,400	2,880	1,750	1,340	3,580	1,820	3,500	2,580	3,500
14	.....	5,260	2,810	1,560	1,340	3,180	2,150	3,110	2,440	3,660
15	.....	5,560	2,080	1,680	1,220	2,880	2,150	2,960	2,440	3,500
16	.....	5,560	2,010	1,940	1,120	2,580	2,150	2,740	2,510	3,260
17	.....	5,560	2,810	1,620	1,120	2,510	1,940	3,340	2,440	3,110
18	.....	4,870	4,400	2,740	1,120	2,510	1,940	3,340	2,360	3,110
19	.....	4,870	8,120	1,180	1,180	2,290	1,620	4,400	2,220	2,960
20	.....	5,260	10,300	1,220	1,560	2,010	1,500	4,200	2,220	2,960
21	.....	4,870	10,100	1,500	1,340	1,750	1,500	4,110	2,360	2,220
22	.....	5,660	10,100	2,010	1,440	2,440	1,220	4,020	2,360	2,220
23	.....	5,760	10,700	2,360	1,440	2,440	1,340	4,020	2,220	2,220
24	.....	3,340	9,070	2,580	1,560	2,220	1,440	3,500	2,290	2,220
25	.....	4,200	9,070	1,820	1,820	2,080	1,620	3,040	2,290	2,220
26	.....	3,660	7,440	1,500	2,010	2,080	1,280	2,960	2,220	2,220
27	.....	2,510	7,330	1,620	2,740	2,290	1,390	2,880	2,220	2,220
28	3,260	3,840	7,680	1,880	2,360	2,290	1,500	2,660	2,440	2,360
29	3,750	3,580	5,860	1,620	2,360	1,940	1,560	2,660	2,360	2,360
30	3,580	3,580	6,860	1,750	2,810	1,940	1,880	2,290	2,290	2,440
31	3,420	.....	5,260	.....	3,260	1,940	.....	2,290	.....	2,440

NOTE.—Daily discharge determined from a well-defined discharge rating curve.

Monthly discharge of Menominee River near Iron Mountain, Mich., for 1911.

[Drainage area, 2,420 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	850	0.351	0.40	D.
February	.....	.....	1,060	.413	.43	D.
March	3,750	.....	1,500	.620	.71	D.
April	5,760	2,440	3,870	1.60	1.78	B.
May	10,700	1,620	4,940	2.04	2.35	B.
June	3,930	1,180	2,180	.901	1.01	B.
July	3,260	1,120	1,690	.698	.80	B.
August	7,330	1,750	3,570	1.48	1.71	A.
September	2,510	1,220	1,870	.773	.86	A.
October	5,860	1,880	3,410	1.41	1.63	A.
November	2,660	2,080	2,300	.950	1.06	A.
December	3,660	1,880	2,560	1.06	1.22	A.
The year	10,700	.....	2,490	1.03	13.96	

NOTE.—Discharge for period during which ice was present estimated from climatologic records and by comparison with records of flow of Escanaba River.
Mean discharge Mar. 1 to 27 estimated at 1,200 second-feet.

WOLF RIVER AND TRIBUTARIES.

WOLF RIVER AT KESHENA, WIS.

Location.—At the highway bridge at Keshena, 3 miles below the mouth of the West Branch.

Records available.—May 9, 1907, to March 31, 1909, and February 10, 1911, to December 31, 1911.

Drainage area.—797 square miles.

Gage.—A vertical staff read twice daily up to October 1, 1911, and three times daily—morning, noon, and night—since that date; mean of the three readings taken as the mean for the day.

Channel.—Permanent.

Discharge measurements.—Made from bridge.

Artificial control.—The flow of the river is controlled by logging dams.

Winter flow.—River freezes over during the winter months.

Accuracy.—The relation of gage height to discharge is affected by ice during the winter, and during the low-water season by the operation of a power plant at the sawmill 1 mile above the station. Conditions favor the accurate determination of discharge.

Cooperation.—Station maintained in cooperation with the United States Indian Office, at whose request it was reestablished.

Discharge measurements of Wolf River at Keshena, Wis., in 1911.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Feet.*	*Sec.-ft.*
Jan. 24[a]	Robert Follansbee	103	216	2.02	363
Feb. 10[a]	C. R. Adams	103	218	2.10	377
Mar. 18[b]	do	107	284	2.13	539
June 26	S. B. Soule	112	248	1.15	428
Dec. 22[b]	C. J. Emerson	102	462	4.45	872

[a] Complete ice cover. [b] Partial ice cover.

Daily gage height, in feet, of Wolf River at Keshena, Wis., for 1911.

[Neil Gauthier, observer.]

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.10	2.12	2.40	2.90	1.48	1.20	1.28	3.43	2.40	5.62
2	.....	2.14	2.15	1.99	3.21	1.45	1.39	1.50	2.85	2.46	5.46
3	.....	2.12	2.05	2.20	2.42	1.22	1.21	1.22	3.31	2.34	5.11
4	.....	2.06	1.92	2.01	2.29	1.49	1.50	1.32	3.79	2.18	5.36
5	.....	2.02	1.62	1.50	3.08	1.18	1.52	1.30	4.85	2.18	5.26
6	.....	2.09	1.36	2.10	2.99	1.32	1.25	1.25	5.24	2.10	5.40
7	.....	2.14	1.42	1.85	2.80	1.22	1.38	1.52	4.48	2.56	5.56
8	.....	2.16	1.41	2.19	2.59	1.62	1.75	1.32	3.77	3.49	5.54
9	.....	2.25	1.62	2.22	2.52	1.58	1.85	1.28	3.70	5.28	5.09
10	2.10	2.32	1.95	1.62	1.71	1.38	1.61	1.55	3.82	6.35	5.36
11	2.11	2.42	1.92	1.70	1.62	1.55	1.51	1.50	3.41	6.74	5.80
12	2.08	2.38	1.78	1.69	2.30	1.48	1.60	1.25	3.38	6.38	5.88
13	2.16	2.32	1.78	2.40	1.08	1.26	1.48	1.30	3.50	6.18	5.85
14	2.22	2.25	2.18	2.18	1.10	1.30	1.30	1.70	3.46	5.89	5.72
15	2.30	2.21	1.98	2.21	1.16	1.25	1.31	1.78	3.22	5.72	5.62
16	2.30	2.45	1.82	1.30	1.28	1.29	1.25	1.35	3.22	6.54	5.00
17	2.32	2.12	1.76	2.36	1.08	1.18	1.18	1.85	3.05	6.35	4.59
18	2.34	2.21	2.65	2.28	.95	1.00	1.22	1.90	2.98	6.24	4.60
19	2.31	2.02	2.48	1.98	1.28	1.05	1.25	1.45	3.00	6.10	4.36
20	2.31	2.02	2.68	2.55	1.46	1.38	1.35	2.10	2.95	5.77	4.25
21	2.20	2.28	2.98	1.84	1.12	1.22	1.58	1.62	2.77	5.72	4.45
22	2.12	2.38	2.08	2.22	1.84	1.45	1.48	1.42	3.24	6.35	4.45
23	2.13	2.22	1.94	2.18	2.22	1.22	1.38	1.31	3.31	6.60	4.38
24	2.16	2.32	1.26	2.26	2.86	1.32	1.60	1.42	3.29	6.38	4.42
25	2.28	2.42	2.95	2.45	2.34	1.60	1.26	1.92	2.68	5.66	4.35
26	2.22	2.45	2.30	1.91	2.15	1.28	1.22	2.35	2.72	6.03	4.34
27	2.21	2.25	2.89	2.25	1.20	1.28	1.42	.....	2.78	6.41	4.38
28	2.12	2.38	2.58	1.78	2.06	1.25	1.48	.....	2.56	6.16	4.41
29	.....	2.36	2.41	2.28	1.55	1.38	1.25	.....	2.22	6.36	4.67
30	.....	2.16	2.92	1.94	1.52	1.12	1.38	.....	2.43	6.31	5.07
31	.....	2.30	.....	1.70	.....	1.50	1.22	.....	2.09	.....	5.28

NOTE.—Relation of gage height to discharge apparently affected by ice from Jan. 1 to about Apr. 17 and Nov. 12 to Dec. 31.

Daily discharge, in second-feet, of Wolf River at Keshena, Wis., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	962	1,220	567	459	489	1,550	962
2	.....	776	1,410	554	532	575	1,190	991
3	.....	869	972	467	463	467	1,470	934
4	.....	784	910	571	575	505	1,780	860
5	.....	575	1,330	451	583	497	2,510	860
6	.....	824	1,270	505	478	478	2,800	824
7	.....	716	1,170	467	528	583	2,250	1,040
8	.....	864	1,060	622	674	505	1,770	1,580
9	.....	878	1,020	606	716	489	1,720	2,830
10	.....	622	658	528	618	594	1,800	.....
11	.....	654	622	594	579	575	1,530	.....
12	.....	650	915	567	614	478	1,510	.....
13	.....	962	413	482	567	497	1,590	.....
14	.....	860	421	497	497	654	1,560	.....
15	.....	874	444	478	501	687	1,410	.....
16	.....	497	489	493	478	516	1,410	.....
17	.....	943	413	451	451	716	1,310	.....
18	1,090	906	364	383	467	737	1,270	.....
19	1,000	771	489	402	478	556	1,280	.....
20	1,100	1,040	559	528	516	824	1,250	.....
21	1,270	712	429	467	606	622	1,150	.....
22	815	878	712	554	567	544	1,430	.....
23	754	860	878	467	528	501	1,470	.....
24	482	897	1,200	505	614	544	1,460	.....
25	1,250	986	934	614	482	746	1,100	.....
26	915	741	846	489	467	938	1,120	.....
27	1,220	892	459	489	544	1,060	1,160	.....
28	1,050	687	806	478	567	1,180	1,040	.....
29	967	906	594	528	478	1,310	878	.....
30	1,230	754	583	429	528	1,430	976	.....
31	.....	654	.....	575	467	.....	820	.....

NOTE.—Daily discharge determined from a rating curve well defined below 1,900 second-feet. Discharge Sept. 27 to 30 interpolated.

Monthly discharge of Wolf River at Keshena, Wis., for 1911.

[Drainage area, 797 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	350	0.439	0.51	D.
February	.....	.....	400	.502	.52	D.
March	.....	.....	500	.627	.72	D.
April	1,270	.....	749	.940	1.05	C.
May	1,040	497	806	1.01	1.16	A.
June	1,410	364	786	.986	1.10	A.
July	622	383	510	.640	.74	A.
August	716	451	536	.673	.78	A.
September	1,430	467	677	.849	.95	A.
October	2,800	820	1,470	1.84	2.12	A.
November	.....	.....	1,520	1.91	2.13	C.
December	.....	.....	1,000	1.25	1.44	D.
The year	.....	.....	777	.975	13.22	

NOTE.—Discharge for periods during which ice was present estimated from four discharge measurements made under ice conditions, climatologic records, and by comparison with records of flow of the West Branch of Wolf River. Mean discharge Apr. 1 to 17 estimated at 550 second-feet; mean discharge Nov. 12 to 30 estimated at 1,300 second-feet.

WEST BRANCH OF WOLF RIVER AT NEOPIT, WIS.

Location.—At the dam and power plant at Neopit, a station of the Wisconsin & Northern Railroad, 20 miles north of Shawano.

Records available.—January 25 to December 31, 1911

Drainage area.—Not measured.

Gages.—Vertical staff.

Determination of flow.—An attempt to measure the flow by current-meter measurements made a short distance below the dam proved unsatisfactory and it was decided to rate the turbine and spillway. The power is developed by means of a timber dam about 14 feet high, which backs the water upstream for a considerable distance and forms a service reservoir. The spillway is a rectangular opening about 13 feet wide, which is closed by means of stop planks. Little water leaks through the dam, but considerable passes between the planks when all are in place. The power house is at the dam and is equipped with a 35-inch Leffel-Samson turbine, belted to a 60-kilowatt generator which is used chiefly for lighting. The turbine takes water from the service reservoir through a rectangular flume which is 9 feet wide by 6 feet deep and is lined with smooth planks. The turbine was rated by means of current-meter measurements in the flume. The spillway and leakage through the boards were rated by measurements in the sluiceway. Gages were placed in the pond and below the dam to show the head on the turbine. Readings of the head gage, daily gage, voltage, amperage, and number of planks removed from the spillway were recorded seven times each day—at 6, 7, and 10 a. m., 12 m., 3, 6, and 10 p. m.; these readings were then weighted in accordance with the elapsed interval.

Accuracy.—A current-meter measurement made December 21, 1911, indicated that the records were being carefully taken and are reliable.

Cooperation.—Station established at the request of the United States Indian Office, as Neopit is on the Menominee Indian Reservation.

Daily discharge, in second-feet, of West Branch of Wolf River at Neopit, Wis., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	60	64	106	99	56	43	75	70	144	134	169
2	.....	60	60	79	65	230	95	80	88	108	156	171
3	.....	60	75	97	137	62	91	77	61	11	144	147
4	.....	60	63	99	160	31	62	80	83	200	150	133
5	.....	60	70	97	91	116	100	61	105	183	157	133
6	.....	60	74	91	75	121	99	60	81	442	174	138
7	.....	60	69	81	54	87	70	139	101	395	199	180
8	.....	60	72	95	133	70	139	143	108	247	145	162
9	.....	60	102	70	102	73	97	94	69	176	175	156
10	.....	60	96	103	90	115	91	108	113	203	202	267
11	.....	60	78	85	409	27	61	45	94	171	207	209
12	.....	60	70	89	201	59	65	92	51	139	190	223
13	.....	60	61	95	87	59	112	94	89	106	159	206
14	.....	60	135	106	19	63	50	81	156	222	135	198
15	.....	60	70	117	132	79	92	92	119	155	210	163
16	.....	60	56	77	153	70	102	70	134	229	136	158
17	.....	60	89	102	135	66	111	63	133	225	140	142
18	.....	60	117	97	114	35	63	79	164	196	146	151
19	.....	57	89	102	94	67	107	126	201	180	185	145
20	.....	62	103	264	107	42	84	111	128	168	202	106
21	.....	60	92	108	107	42	48	96	89	136	136	129
22	.....	60	55	239	124	80	67	77	144	155	156	166
23	.....	63	78	59	116	39	90	73	112	178	170	178
24	.....	56	110	61	126	44	97	68	111	205	167	148
25	60	65	101	116	101	109	93	70	121	210	156	120
26	60	58	79	96	100	52	87	93	77	161	129	125
27	60	64	93	76	94	51	61	60	131	178	166	124
28	60	57	123	73	87	97	99	76	97	156	164	126
29	60	.....	118	157	104	61	79	65	141	162	138	131
30	60	.....	121	87	26	108	56	78	148	154	137	146
31	60	.....	114	.....	64	.....	99	85	.....	149	.....	140

NOTE.—Daily discharge computed from ratings of the turbine, spillway, and leakage. See description.

Monthly discharge of West Branch of Wolf River at Neopit, Wis., for 1911.

Month.	Discharge in second-feet.			Accuracy.
	Maximum.	Minimum.	Mean.	
January 25–31	60	60	60.0	B.
February	65	56	60.1	B.
March	135	55	87.0	B.
April	264	59	104	B.
May	409	19	111	B.
June	230	27	73.7	B.
July	139	43	84.2	B.
August	143	60	84.2	B.
September	201	51	111	B.
October	442	108	189	B.
November	210	129	162	B.
December	267	106	158	B.

GRAND RIVER AT GRAND RAPIDS, MICH.

Location.—At Fulton Street Bridge in Grand Rapids, Mich.

Records available.—March 12, 1901, to December 31, 1911.

Drainage area.—4,900 square miles.

Gage.—Staff, attached to bridge. In November, 1907, a new staff gage with zero corresponding to the city datum was attached to the abutment of the bridge. Readings on this gage were first reported in December, 1907. The zero of the gage in use prior to November, 1907, was 0.55 foot below the city datum; all gage readings, however, were corrected to the city datum and all published gage heights are therefore referred to the same datum.

Discharge measurements.—Made from downstream side of the bridge.

Winter flow.—Somewhat affected by ice.

Artificial control.—The operation of power plants above the station may modify the low-water flow.

Accuracy.—The two or three measurements made at this station since 1905 indicate that the 1905 discharge curve is not applicable after that year.

Cooperation.—Records furnished by the city engineer of Grand Rapids.

Daily gage height, in feet, of Grand River at Grand Rapids, Mich., for 1911.

[F. F. Smith, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.20	2.52	−0.02	1.45	−0.40	−0.65	−1.30	−1.35	.....	1.32	3.10
2	.....	2.20	2.10	.....	2.48	− .25	.....	−1.12	−1.35	4.15	1.15	3.05
3	−0.65	1.75	1.72	− .10	1.90	− .20	−0.75	−1.10	.....	4.48	1.15	.....
4	− .50	1.45	1.45	− .02	1.62	.....	.....	−1.10	.....	4.15	1.20	2.98
5	− .30	.....	.....	.65	1.45	.95	−0.35	−1.25	−1.30	4.00	.....	2.72
6	− 20	1.15	0.92	1.50	1.22	2.75	− .50	.....	−1.30	4.00	0.95	2.35
7	− .05	1.00	.65	2.92	.....	3.52	− .45	−1.45	−1.30	4.95	1.00	2.70
8	.....	0.80	.48	2.97	0.65	3.32	− .85	−1.45	−1.30	.....	1.20	2.80
9	− .10	.80	.28	.....	.30	2.45	.....	−1.45	−1.25	4.50	1.30	3.25
10	− .15	.70	.18	2.72	.10	2.05	−1.00	−1.40	.....	4.35	1.22	.....
11	− .15	.60	.08	2.47	.05	.....	−0.95	−1.40	−1.25	4.10	1.40	3.50
12	.05	.....	.....	2.45	− .02	1.12	−1.00	−1.35	−1.25	3.38	.....	3.90
13	.30	.40	.25	2.87	− .02	0.55	−0.95	.....	−1.15	3.38	5.00	3.98
14	.40	2.10	.55	2.62	.....	.35	− .85	−1.35	−1.15	3.15	5.30	3.75
15	.....	4.60	.48	2.42	− .32	.27	− .82	−1.35	−1.00	.....	4.88	3.55
16	.50	5.38	.35	.....	− .62	.22	.....	−1.35	−0.90	2.20	4.62	3.28
17	.70	6.58	.18	2.05	− .80	.32	−1.10	−1.35	.....	2.52	4.45	.....
18	.75	7.98	.08	1.87	− .70	.....	−1.20	−1.35	− .90	2.88	5.55	2.80
19	.65	.....	.....	2.32	− .60	− .40	−1.10	−1.35	− .90	2.88	.....	2.30
20	.60	7.42	− .02	2.65	− .35	− .80	−1.25	.....	− .82	2.50	6.75	2.10
21	.25	7.00	− .10	2.40	.....	− .90	−1.15	−1.35	− .78	2.80	6.55	1.75
22	.....	.....	− .15	1.97	1.15	− .80	−1.10	−1.40	− .78	.....	6.30	1.95
23	.05	4.98	− .18	.....	1.90	− .85	.....	−1.35	− .78	3.45	6.15	2.80
24	− .08	4.15	− .12	1.22	2.10	− .88	− .92	−1.35	.....	3.60	4.75	.....
25	− .28	3.40	− .02	0.90	1.40	.....	−1.00	−1.35	− .75	3.30	4.15	.....
26	− .40	.....	.....	.85	0.85	.65	−1.20	−1.35	− .75	2.95	.....	2.70
27	.08	3.22	.02	.70	.32	− .35	−1.30	.....	− .65	2.85	3.35	2.90
28	1.00	2.92	− .02	.35	.....	− .60	−1.30	−1.35	− .70	2.48	3.20	2.60
29	.....	.....	− .12	.05	− .37	− .60	−1.30	−1.35	− .25	.....	3.50	0.80
30	1.95	.....	− .10	.....	.....	− .60	.....	−1.35	0.45	1.72	.....	1.05
31	1.90	.....	− .08	.....	− .27	.....	−1.30	−1.35	.....	1.52	.....	.....

NOTE.—Relation between gage height and discharge probably to some extent affected by ice during January, February, March, and December.

MANISTEE RIVER NEAR SHERMAN, MICH.

Location.—At north bridge, 1 mile from Sherman, Mich., immediately above the mouth of Wheeler Creek.

Records available.—July 10, 1903, to December 31, 1911.

Drainage area.—900 square miles.

Gage.—Standard chain; datum unchanged.

Channel.—Probably permanent.

Discharge measurements.—Made from downstream side of bridge.

Winter flow.—Special studies are necessary to determine the winter flow as the stream freezes over. The constancy of flow is remarkable, and is due to the fact that the supply is derived from springs and ground water. The maximum recorded mean flow for any month from 1903 to 1908 is only two and one-half times the minimum recorded flow. Consequently a fairly close estimate of the discharge for the periods during which ice is present can be made by using climatological data and the general records.

Accuracy.—Observations in 1910-11 indicate that the relation of gage height to discharge remains unchanged, but may at times be affected by backwater from log jams.

Cooperation.—Station maintained in cooperation with William G. Fargo.

The following discharge measurement was made by V. H. Reineking:
September 20, 1911: Gage height, 2.00 feet; discharge, 904 second-feet.

Daily gage height, in feet, of Manistee River near Sherman, Mich., for 1911.

[M. I. and M. Munn, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.20	2.30	2.30	3.55	3.50	4.00	2.42	2.15	1.99	2.46	2.68	2.88
2	2.30	2.30	2.38	3.28	4.00	3.95	2.40	2.19	1.97	2.50	2.68	2.96
3	2.30	2.30	2.35	3.04	4.10	3.75	2.40	2.14	1.96	2.64	2.64	2.98
4	2.30	2.30	2.30	3.00	4.05	3.80	2.35	2.10	1.98	2.85	2.56	2.84
5	2.40	2.22	2.22	3.32	3.82	3.80	2.25	2.10	2.00	2.78	2.56	2.77
6	2.40	2.20	2.20	3.70	3.58	3.65	2.42	2.10	2.08	3.30	2.63	2.76
7	2.40	2.12	2.20	3.70	3.42	3.45	2.38	2.10	2.19	3.99	2.81	2.81
8	2.50	2.10	2.20	3.60	3.25	3.26	2.29	2.10	2.26	3.90	2.92	2.87
9	2.50	2.10	2.28	3.60	3.12	3.19	2.28	2.20	2.20	3.78	2.86	3.05
10	2.50	2.10	2.50	3.65	3.09	3.12	2.27	2.25	2.18	3.62	2.88	3.78
11	2.50	2.20	2.70	3.72	3.06	3.05	2.29	2.21	2.20	3.40	3.00	4.78
12	2.50	2.30	2.90	3.86	2.90	3.00	2.30	2.19	2.30	3.14	4.32	4.98
13	2.50	2.30	3.00	4.12	2.70	3.00	2.24	2.12	2.15	2.98	4.22	5.06
14	2.50	2.45	3.10	4.62	2.78	3.00	2.20	2.09	2.20	2.88	4.12	4.89
15	2.50	2.50	3.20	5.28	2.80	2.92	2.20	2.05	2.18	2.78	3.94	4.65
16	2.50	2.50	3.12	5.58	3.00	2.83	2.20	2.07	2.14	2.70	3.69	4.20
17	2.50	2.50	2.95	5.50	3.68	2.94	2.15	2.07	2.14	3.02	3.65	3.76
18	2.40	2.45	2.85	5.10	4.20	3.05	2.14	2.04	2.10	3.14	3.60	3.55
19	2.40	2.40	2.90	4.72	4.45	2.85	2.15	2.02	2.07	3.08	3.55	3.45
20	2.50	2.40	2.95	4.45	4.50	2.65	2.14	2.08	2.01	2.98	3.40	3.22
21	2.50	2.35	3.23	4.25	4.45	2.60	2.10	2.02	2.08	2.83	3.28	3.12
22	2.50	2.30	3.50	4.12	5.02	2.52	2.08	2.05	2.04	2.88	3.22	3.02
23	2.50	2.35	3.82	4.02	5.60	2.50	2.06	2.03	2.02	3.14	3.12	3.04
24	2.50	2.40	3.48	3.92	5.70	2.50	2.18	1.99	2.00	3.25	3.06	3.04
25	2.50	2.42	3.40	3.75	5.68	2.50	2.28	1.97	2.01	3.25	3.04	3.01
26	2.40	2.50	3.36	3.55	5.15	2.65	2.29	1.96	2.06	3.19	2.92	2.96
27	2.40	2.45	3.55	3.42	4.60	2.70	2.28	1.94	2.04	3.08	2.94	2.92
28	2.50	2.38	3.75	3.34	4.10	2.60	2.25	1.95	2.03	2.92	2.98	2.80
29	2.50	.....	3.85	3.30	3.82	2.50	2.21	2.10	2.34	2.88	2.97	2.62
30	2.40	.....	3.79	3.30	3.50	2.50	2.15	2.07	2.40	2.78	2.98	2.68
31	2.35	.....	3.70	.....	3.70	.....	2.11	2.02	.....	2.69	.....	2.87

NOTE.—Ice present Jan. 5 to 28; relation of gage height to discharge apparently but little affected. A log jam formed above the station July 11 and caused a slight lowering of stage.

Daily discharge, in second-feet, of Manistee River near Sherman, Mich., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	952	987	987	1,480	1,460	1,680	1,030	934	880	1,050	1,130	1,210
2	987	987	1,020	1,370	1,680	1,660	1,020	948	873	1,060	1,130	1,240
3	987	987	1,000	1,270	1,730	1,570	1,020	931	870	1,110	1,110	1,240
4	987	987	987	1,250	1,700	1,590	1,000	917	876	1,190	1,080	1,190
5	1,020	959	959	1,380	1,600	1,590	970	917	883	1,170	1,080	1,160
6	1,020	952	952	1,550	1,500	1,530	1,030	917	910	1,380	1,110	1,160
7	1,020	924	952	1,550	1,430	1,440	1,020	917	948	1,680	1,180	1,180
8	1,060	917	952	1,500	1,360	1,360	984	917	973	1,640	1,220	1,200
9	1,060	917	980	1,500	1,300	1,330	980	952	952	1,580	1,200	1,270
10	1,060	917	1,060	1,530	1,290	1,300	976	970	945	1,510	1,210	1,580
11	1,060	952	1,140	1,560	1,280	1,270	984	956	952	1,420	1,250	2,050
12	1,060	987	1,210	1,620	1,210	1,250	987	948	987	1,310	1,830	2,150
13	1,060	987	1,250	1,740	1,140	1,250	966	924	934	1,240	1,780	2,190
14	1,060	1,040	1,290	1,970	1,170	1,250	952	914	952	1,210	1,740	2,100
15	1,060	1,060	1,330	2,300	1,170	1,220	952	900	945	1,170	1,650	1,990
16	1,060	1,060	1,300	2,460	1,250	1,190	952	907	931	1,140	1,540	1,770
17	1,060	1,060	1,230	2,410	1,540	1,230	934	907	931	1,260	1,530	1,570
18	1,020	1,040	1,190	2,210	1,770	1,270	931	897	917	1,310	1,500	1,480
19	1,020	1,020	1,210	2,020	1,890	1,190	934	890	907	1,280	1,480	1,440
20	1,060	1,020	1,230	1,890	1,910	1,120	931	910	886	1,240	1,420	1,340
21	1,060	1,000	1,350	1,800	1,890	1,100	917	890	910	1,190	1,370	1,300
22	1,060	987	1,460	1,740	2,170	1,070	910	900	897	1,210	1,340	1,260
23	1,060	1,000	1,590	1,690	2,470	1,060	903	893	890	1,310	1,300	1,270
24	1,060	1,020	1,450	1,640	2,520	1,060	945	880	883	1,360	1,280	1,270
25	1,060	1,030	1,420	1,570	2,510	1,060	980	873	886	1,360	1,270	1,260
26	1,020	1,060	1,400	1,480	2,240	1,120	984	870	903	1,330	1,220	1,240
27	1,020	1,040	1,480	1,430	1,960	1,140	980	863	897	1,280	1,230	1,220
28	1,060	1,020	1,570	1,390	1,730	1,100	970	866	893	1,220	1,240	1,170
29	1,060	.....	1,610	1,380	1,600	1,060	956	917	1,000	1,210	1,240	1,100
30	1,020	.....	1,590	1,380	1,460	1,060	934	907	1,020	1,170	1,240	1,130
31	1,000	.....	1,550	.....	1,550	.....	920	890	.....	1,130	.....	1,200

NOTE.—Daily discharge determined from a rating curve well defined below 1,700 second-feet. No correction for ice.

Monthly discharge of Manistee River near Sherman, Mich., for 1911.

[Drainage area, 900 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	1,060	952	1,040	1.16	1.34	C.
February	1,060	917	997	1.11	1.24	B.
March	1,610	952	1,250	1.39	1.60	B.
April	2,460	1,250	1,670	1.86	2.08	A.
May	2,520	1,140	1,660	1.84	2.12	A.
June	1,680	1,060	1,270	1.41	1.57	A.
July	1,030	903	966	1.07	1.23	A.
August	970	863	910	1.01	1.16	A.
September	1,020	870	921	1.02	1.14	A.
October	1,680	1,050	1,280	1.42	1.64	A.
November	1,830	1,080	1,330	1.48	1.65	A.
December	2,190	1,100	1,420	1.58	1.82	B.
The year	2,520	863	1,230	1.37	18.59	

STREAMS TRIBUTARY TO LAKE HURON.

AU SABLE RIVER AT BAMFIELD, MICH.

Location.—At remains of old wooden highway bridge at Bamfield, near Glennie post office, Mich., in the NW. ¼ sec. 14, T. 25 N., R. 5 E., about 600 feet above the mouth of Bamfields Creek.

Records available.—August 27, 1902, to December 31, 1911.

Drainage area.—1,420 square miles.

Gage.—Staff; fastened to wooden crib pier of the old bridge about 600 feet above the steel bridge; datum unchanged.

Channel.—Probably permanent.

Discharge measurements.—Made from the steel bridge about 600 feet below the wooden bridge at which measurements were formerly made. The steel bridge was begun in March and completed in July, 1907; part of the wooden bridge was removed when the steel bridge was finished. Bamfields Creek, which enters immediately above the steel bridge, carries only a few second-feet of water.

Winter flow.—The river is frozen over two or three months each year, but open places, probably caused by inflow from springs, are found throughout the winter.

Accuracy.—The relation between gage height and discharge is affected for short periods during the logging season by backwater from log jams and at times during the winter by backwater from anchor ice. Changes made in the channel below the gage when the new bridge was erected caused slight backwater at the gage. The station has not been inspected since March, 1909.

Cooperation.—Station maintained in cooperation with William G. Fargo.

Daily gage height, in feet, of Au Sable River at Bamfield, Mich., for 1911.

[Mrs. W. H. Bamfield, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.62	2.36	1.26	2.32	2.55	2.55	1.90	1.19	1.39	1.80	1.98	3.05
2	2.16	2.68	1.26	2.46	3.02	2.50	1.86	1.29	1.29	1.80	1.96	3.02
3	2.25	2.39	1.26	1.92	2.85	2.42	1.83	1.29	1.35	1.85	2.00	3.00
4	2.36	2.41	1.24	1.96	2.75	2.32	1.69	1.30	1.38	2.18	1.88	2.02
5	2.68	2.05	1.22	2.32	2.52	2.36	1.64	1.28	1.24	2.12	1.89	2.11
6	2.91	1.95	1.21	2.75	2.39	2.36	1.56	1.30	1.23	2.48	1.78	2.12
7	3.30	1.72	1.18	2.76	2.24	2.30	1.54	1.28	1.40	2.80	1.90	2.10
8	2.85	2.44	1.15	2.48	2.12	2.26	1.49	1.25	1.50	2.90	2.16	2.12
9	2.76	2.31	1.25	2.51	2.11	2.20	1.39	1.20	1.42	2.64	2.30	2.22
10	2.72	1.61	1.30	2.70	2.02	2.22	1.36	1.26	1.40	2.55	2.21	2.78
11	2.80	2.15	1.50	2.95	2.05	2.24	1.30	1.30	1.37	2.39	2.19	3.50
12	3.12	2.78	1.55	3.30	2.00	2.24	1.24	1.25	1.34	2.29	3.10	4.05
13	3.58	2.91	1.51	3.35	1.90	2.30	1.20	1.22	1.28	2.38	4.10	3.58
14	3.05	2.72	1.79	4.45	1.88	2.28	1.10	1.18	1.25	2.08	3.85	3.45
15	.....	2.80	1.86	4.45	1.92	1.95	1.05	1.24	1.38	1.92	3.70	3.24
16	.....	2.90	1.75	3.75	2.15	1.94	1.10	1.35	1.51	1.78	3.50	3.12
17	.....	3.30	1.60	3.62	2.51	1.95	1.11	1.47	1.40	2.08	3.38	3.02
18	.....	1.46	1.51	3.50	3.10	1.86	1.15	1.44	1.36	2.28	3.30	3.09
19	.....	1.39	1.48	3.51	3.08	1.70	1.21	1.28	1.28	2.38	3.19	3.05
20	.....	1.35	1.45	3.25	2.98	1.70	1.25	1.26	1.18	2.25	2.02	2.95
21	2.69	1.38	1.64	2.95	2.94	1.68	1.26	1.24	1.20	2.05	2.02	2.55
22	2.95	1.40	1.86	2.85	3.08	1.66	1.28	1.21	1.26	2.02	2.12	2.46
23	2.88	1.29	2.00	2.48	3.40	1.61	1.30	1.22	1.20	2.28	2.21	2.40
24	2.78	1.22	1.90	2.50	3.72	1.58	1.31	1.20	1.22	2.35	2.22	2.36
25	2.72	1.22	1.90	2.45	3.55	1.51	1.30	1.16	1.27	2.26	2.32	2.32
26	2.64	1.32	2.34	2.40	3.36	1.52	1.26	1.10	1.30	2.15	2.35	2.30
27	2.78	1.32	2.85	2.30	2.95	1.58	1.28	1.15	1.42	2.08	2.32	2.24
28	2.78	1.32	3.05	2.28	2.68	1.64	1.28	1.21	1.32	2.00	2.26	2.19
29	2.85	.....	3.44	2.26	2.49	1.60	1.24	1.28	1.48	2.02	2.18	2.12
30	2.46	.....	2.62	2.29	2.29	1.62	1.20	1.32	1.56	1.95	2.38	2.12
31	2.51	.....	2.40	.....	2.35	.....	1.18	1.38	.....	1.92	.....	2.12

NOTE.—Relation between gage height and discharge affected by ice Jan. 1 to Feb. 18, and during December; gage heights for these periods read to water surface.

STREAMS TRIBUTARY TO LAKE ERIE.

HURON RIVER AT DEXTER, MICH.

Location.—At the highway bridge at Dexter, Mich., a short distance below the mouth of Mill Creek.

Records available.—September 1, 1904, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Standard chain, attached to bridge; installed March 26, 1908, at the same datum as the staff gage which was in use until March 12, 1908, when it was carried out by ice; datum unchanged.

Channel.—The high water that carried out the gage produced permanent change in the bed of the river; a small head race runs to an abandoned mill on the left bank, but at ordinary stages little or no water flows into this canal; at high stages a small amount of water may pass around the gage through this race.

Discharge measurements.—Made from a boat several hundred feet below the gage or from the bridge to which the gage is attached.

Winter flow.—As the current is swift, little ice forms at this section.

Accuracy.—Relation between gage height and discharge that existed prior to March 12, 1908, was altered as the result of the change in the river bed produced at that time; gage heights are only slightly affected by ice. The station was last inspected October 17, 1908.

Cooperation.—Station maintained in cooperation with the Eastern Michigan Edison Co., Washtenaw division, Ann Arbor, Mich.

Daily gage height, in feet, of Huron River at Dexter, Mich., for 1911.

[D. M. Litchfield, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.00	0.62	0.78	0.20	0.45	−0.30	−0.30	−0.42	−0.40	0.05	0.18	0.52
2	.15	.58	.65	.22	.50	−.30	−.30	−.38	−.40	.20	.12	.48
3	.40	.52	.62	.20	.42	−.22	−.30	−.38	−.40	.28	.10	.52
4	.60	.50	.60	.20	.40	−.20	−.30	−.40	−.40	.30	.10	.50
5	.70	.50	.55	.50	.40	.15	−.35	−.40	−.45	.30	.10	.48
6	.70	.50	.52	.50	.42	.20	−.35	−.40	−.40	.32	.12	.48
7	.70	.48	.50	.50	.30	.10	−.40	−.40	−.35	.40	.20	.48
8	.30	.45	.45	.50	.25	.10	−.38	−.40	−.40	.40	.20	.48
9	.30	.40	.40	.50	.22	.10	−.40	−.40	−.35	.38	.22	.55
10	.60	.45	.40	.45	.20	.10	−.40	−.40	−.38	.38	.25	.58
11	.55	.42	.40	.40	.20	.10	−.35	−.38	−.35	.38	.28	.65
12	.55	.38	.40	.40	.15	−.02	−.38	−.40	−.30	.30	.32	.68
13	.60	.58	.55	.50	.10	−.02	−.40	−.40	−.30	.30	.42	.62
14	.75	1.30	.60	.50	.08	−.02	−.42	−.40	−.30	.25	.45	.62
15	.60	1.30	.60	.45	.00	−.08	−.45	−.35	−.20	.28	.42	.60
16	.75	1.60	.58	.40	.00	−.10	−.45	−.32	−.20	.20	.48	.58
17	.75	1.70	.50	.40	.00	−.10	−.48	−.30	−.20	.28	.52	.55
18	.60	1.70	.42	.38	.00	−.12	−.50	−.38	−.20	.30	.88	.52
19	.60	1.65	.38	.40	−.10	−.15	−.45	−.40	−.20	.25	.85	.50
20	.60	1.45	.35	.95	−.10	−.12	−.45	−.40	−.30	.20	.78	.48
21	.60	1.28	.35	.90	−.10	−.20	−.45	−.30	−.22	.22	.70	.48
22	.60	1.18	.38	.75	−.08	−.22	−.45	−.32	−.22	.22	.70	.55
23	.70	1.08	.45	.68	−.12	−.28	−.50	−.35	−.22	.20	.70	.60
24	.62	1.00	.42	.62	−.20	−.25	−.50	−.30	−.25	.20	.68	.58
25	.55	1.00	.35	.52	−.20	−.20	−.48	−.30	−.30	.20	.70	.58
26	.55	0.98	.30	.50	−.22	−.20	−.50	−.35	−.28	.18	.65	.50
27	.80	.88	.25	.48	−.30	−.20	−.48	−.40	−.20	.15	.60	.45
28	1.00	.80	.25	.40	−.30	−.20	−.48	−.40	−.15	.15	.65	.32
29	.85	.....	.20	.45	−.30	−.28	−.45	−.35	−.08	.12	.78	.55
30	.70	.....	.20	.48	−.30	−.30	−.48	−.35	−.08	.12	.50	.42
31	.70	.....	.20	.....	−.30	.....	−.48	−.38	.....	.15	.....	.42

NOTE.—Relation between gage height and discharge affected by backwater from ice ams during January and to some extent by ice during December.

HURON RIVER AT GEDDES, MICH.

Location.—At dam and power plant of the Eastern Michigan Edison Co. at Geddes, Mich., half a mile above mouth of Fleming Creek.

Records available.—February 1, 1904, to December 31, 1911.

Drainage area.—757 square miles.

Determination of discharge.—The flow of the river at this point is computed from records of the operation of the power plant and records of the depth of the flow over the dam.

Cooperation.—The estimates are made and furnished by G. S. Williams.

Daily discharge, in second-feet, of Huron River at Geddes, Mich., for 1911.

[Drainage area, 757 square miles.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	167	436	549	392	464	80	87	61	77	321	258	515
2	203	462	572	304	489	90	148	92	84	298	279	478
3	143	430	502	413	489	126	111	91	61	258	258	294
4	189	497	495	441	464	142	134	103	136	260	258	347
5	169	434	497	597	439	260	56	82	39	363	218	454
6	184	221	503	564	445	310	99	62	93	393	298	486
7	173	299	448	584	360	264	94	52	103	412	273	450
8	214	296	431	535	369	213	84	63	78	352	296	412
9	196	299	409	461	365	254	97	70	71	437	324	524
10	205	311	412	516	350	273	83	112	76	416	312	488
11	273	298	476	537	358	218	91	124	119	389	320	475
12	299	349	450	537	294	287	218	67	86	378	384	471
13	310	369	515	546	280	200	100	32	81	388	477	479
14	344	692	491	535	195	212	64	63	118	359	422	484
15	470	1,025	485	541	273	194	80	93	125	350	442	502
16	427	1,022	355	384	242	188	79	75	130	300	424	495
17	435	1,068	434	459	224	178	60	132	82	325	495	519
18	362	1,050	417	458	222	116	76	70	120	294	749	523
19	317	1,036	365	531	181	146	63	88	146	326	734	537
20	365	930	383	1,136	185	140	61	78	125	313	602	548
21	340	847	411	986	129	148	66	73	102	319	559	553
22	248	808	360	808	176	138	72	87	115	319	549	463
23	306	755	401	564	181	95	62	91	143	354	549	466
24	307	753	358	691	162	79	60	86	140	332	550	454
25	310	830	328	654	151	104	61	105	56	291	542	459
26	320	759	318	602	148	83	62	75	132	294	473	469
27	532	582	368	560	156	124	56	81	258	291	517	459
28	662	599	377	524	68	118	56	69	262	284	574	485
29	736	.....	389	505	126	105	55	140	257	225	620	406
30	532	.....	379	380	97	94	47	45	206	284	567	477
31	451	.....	381	.....	115	.....	64	78	.....	256	.....	515

NOTE.—Daily discharge July 1 to Sept. 30 and Oct. 15 to 17 estimated from records at the Superior dam, about 1½ miles below Geddes.

Monthly discharge of Huron River at Geddes, Mich., for 1911.

[Drainage area, 757 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area.)
	Maximum.	Minimum.	Mean.	Per square mile.	
January	736	143	329	0.435	0.50
February	1,070	221	623	.823	.86
March	572	318	428	.565	.65
April	1,140	304	558	.737	.82
May	489	68	264	.349	.40
June	310	79	166	.219	.24
July	218	47	82.1	.108	.12
August	140	32	81.9	.108	.12
September	258	39	119	.157	.18
October	437	225	328	.433	.50
November	749	218	444	.586	.65
December	553	294	474	.626	.72
The year	1,140	32	322	.425	5.76

HURON RIVER AT FLAT ROCK, MICH.

Location.—At the highway bridge at Flat Rock, Mich., half a mile below the crossing of the Detroit, Toledo & Ironton Railroad.

Records available.—August 6, 1904, to December 31, 1911.

Drainage area.—1,000 square miles.

Gage.—Staff; datum unchanged.

Channel.—Probably permanent.

Discharge measurements.—Made from downstream side of bridge.

Artificial control.—At ordinary stages the flow of the river is controlled by a dam and power plant immediately above the station, but the operation of this plant is assumed to have little effect on the diurnal fluctuations of stage.

Winter flow.—Ice jams form below the station and cause backwater at the gage; in general the section above the station is kept open by the power plant.

Accuracy.—Station was last inspected October 16, 1908. Records probably fair.

Cooperation.—Station maintained in cooperation with the Eastern Michigan Edison Co., Washtenaw division, Ann Arbor, Mich.

Daily gage height, in feet, of Huron River at Flat Rock, Mich., for 1911.

[C. L. Mettler, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.4	3.45	3.25	1.9	2.5	0.9	0.8	0.35	0.5	1.3	1.7	3.15
2	1.35	3.4	3.5	1.85	2.6	1.0	.8	.3	.45	1.3	1.75	3.15
3	1.75	3.5	2.9	1.85	2.6	.95	.75	.6	.4	2.3	1.8	2.6
4	1.7	3.05	2.55	2.2	2.6	.95	.8	.35	.6	2.0	1.6	2.45
5	1.6	3.05	2.55	2.45	2.5	1.15	.75	.4	.5	1.9	1.65	2.95
6	1.6	3.0	2.4	3.05	2.35	1.85	.75	.5	.5	1.85	1.6	2.9
7	1.9	3.0	2.5	3.35	2.1	1.95	.7	.75	.4	2.15	1.95	2.75
8	2.0	2.35	2.35	2.95	2.05	1.6	.75	.6	.45	2.2	2.05	2.6
9	2.0	2.65	2.3	2.85	2.2	1.55	.7	.45	.45	2.3	1.9	2.8
10	2.15	2.6	2.2	2.75	1.85	1.7	.65	.45	.5	2.45	1.9	2.5
11	1.9	2.65	2.1	2.75	1.95	1.55	.7	.4	.9	2.4	2.0	.....
12	2.85	2.4	2.05	2.7	1.9	1.55	.6	.....	.35	2.25	2.05	3.55
13	2.8	2.8	2.3	2.7	1.75	1.75	.65	.....	.35	2.05	2.2	3.45
14	2.8	4.7	2.65	2.85	1.45	1.4	.6	.7	.55	2.0	2.85	3.25
15	2.9	5.9	2.65	2.8	1.1	1.3	.6	.6	.6	2.0	2.6	3.0
16	2.85	6.0	2.55	.....	1.6	1.15	.65	.45	.8	2.1	2.75	3.0
17	3.1	5.9	2.0	2.6	1.5	1.25	.4	.55	.75	2.15	2.6	2.95
18	2.95	5.9	2.35	2.6	1.5	1.25	.4	.5	.8	1.95	3.45	2.85
19	3.0	6.3	.....	2.55	1.45	.9	.5	.5	.5	2.0	4.3	3.0
20	2.9	5.95	2.0	3.65	1.35	1.1	.7	.7	.6	1.9	3.75	2.8
21	2.7	5.25	1.9	4.6	.....	.95	.75	.65	.75	1.9	3.7	2.95
22	2.65	4.6	2.15	4.4	.95	1.0	.6	.45	.8	1.9	3.35	2.75
23	2.35	4.45	2.05	3.85	1.4	1.1	.55	.4	.75	1.9	3.35	2.75
24	2.7	4.2	2.25	3.45	1.2	.95	.55	.4	.6	1.95	3.25	2.75
25	2.55	3.65	1.9	3.35	1.25	1.0	.4	.45	.5	1.95	3.3	2.5
26	2.6	3.55	1.95	3.0	1.05	.9	.3	.4	.4	1.9	3.0	2.6
27	2.9	3.65	2.0	2.95	.95	.9	.45	.45	.6	1.9	2.4	3.05
28	3.5	3.5	1.65	2.8	.95	.95	.4	.7	1.0	1.8	3.25	2.5
29	4.15	.....	1.9	2.65	.85	.95	.4	.45	1.3	1.8	3.75	1.8
30	4.15	.....	2.15	2.55	.8	.9	.4	.4	1.25	1.65	3.65	2.2
31	4.0	.....	2.1	.....	.9	.....	.3	.55	.....	1.9	.....	2.6

NOTE.—Relation between gage height and discharge little, if at all, affected by ice during the winter.

Daily discharge, in second-feet, of Huron River at Flat Rock, Mich., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	312	864	802	427	583	211	192	116	140	291	379	772
2	302	849	880	415	611	230	192	109	132	291	391	772
3	391	880	697	415	611	220	183	157	124	529	403	611
4	379	742	597	503	611	220	192	116	157	452	356	570
5	356	742	597	570	583	260	183	124	140	427	368	712
6	356	727	556	742	542	415	183	140	140	415	356	697
7	427	727	583	834	477	440	174	183	124	490	440	654
8	452	542	542	712	464	356	183	157	132	503	464	611
9	452	625	529	682	503	345	174	132	132	529	427	668
10	490	611	503	654	415	379	166	132	140	570	427	583
11	427	625	477	654	440	345	174	124	211	556	452	740
12	682	556	464	639	427	345	157	111	116	526	464	896
13	668	668	529	639	391	391	166	157	116	464	503	864
14	668	1,280	625	682	323	312	157	174	148	452	682	802
15	697	1,700	625	668	250	291	157	157	157	452	611	727
16	682	1,730	597	640	356	260	166	132	192	477	654	727
17	757	1,700	452	611	334	280	124	148	183	490	611	712
18	712	1,700	542	611	334	280	124	140	192	440	864	682
19	727	1,840	497	597	323	211	140	140	140	452	1,140	727
20	697	1,710	452	927	302	250	174	174	157	427	959	668
21	639	1,470	427	1,240	261	220	183	166	183	427	943	712
22	625	1,240	490	1,170	220	230	157	132	192	427	834	654
23	542	1,190	464	991	312	250	148	124	183	427	834	654
24	639	1,110	516	864	270	220	148	124	157	440	802	654
25	597	927	427	834	280	230	124	132	140	440	818	583
26	611	896	440	727	240	211	109	124	124	427	727	611
27	697	927	452	712	220	211	132	132	157	427	556	742
28	880	880	368	668	220	220	124	174	230	403	802	583
29	1,090	.....	427	625	202	220	124	132	291	403	959	403
30	1,090	.....	490	597	192	211	124	124	280	368	927	503
31	1,040	.....	477	.....	211	.....	109	148	.....	427	.....	611

NOTE.—Daily discharge determined from a fairly well defined rating curve. Discharge interpolated for days on which gage was not read. No correction for effect of ice.

Monthly discharge of Huron River at Flat Rock, Mich., for 1911.

[Drainage area, 1,000 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum	Mean.	Per square mile.		
January	1,090	302	616	0.616	0.71	D.
February	1,840	542	1,050	1.05	1.09	D.
March	880	368	533	.533	.61	C.
April	1,240	415	702	.702	.78	B.
May	611	192	371	.371	.43	B.
June	440	211	275	.275	.31	B.
July	192	109	156	.156	.18	B.
August	183	109	141	.141	.16	B.
September	291	116	164	.164	.18	B.
October	570	291	447	.447	.52	B.
November	1,140	356	638	.638	.71	B.
December	896	403	674	.674	.78	C.
The year	1,840	109	476	.476	6.46	

CATTARAUGUS CREEK AT VERSAILLES, N. Y.

Location.—On a three-span highway bridge in the village of Versailles, about 6 miles below Gowanda, 2¼ miles above the mouth of Clear Creek (coming in from the right), and about 8 miles above the mouth of the stream.

Records available.—September 23, 1910, to December 31, 1911. Data published also in annual reports of the State Water Supply Commission of New York, New York State Conservation Commission, and New York State engineer and surveyor.

Drainage area.—467 square miles.

Gage.—Chain, fastened to the upstream side of the second span from the right-hand end of the bridge; read twice daily; datum unchanged.

Channel.—Rock and gravel; considered permanent.

Discharge measurements.—Made from the downstream side of the bridge.

Winter flow.—Relation of gage height to discharge affected by ice.

Accuracy.—Discharge curve not sufficiently developed to warrant the publication of table of daily discharge.

Cooperation.—Station established by United States Geological Survey in cooperation with the State Water Supply Commission of New York.

Discharge measurements of Cattaraugus Creek at Versailles, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 13[a]	F. J. Shuttleworth	5.55	542
Apr. 18	C. S. DeGolyer	5.90	928

[a] Ice along shore may have affected gage height.

Daily gage height, in feet, of Cattaraugus River at Versailles, N. Y., for 1911.

[James A. Palmer, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.60	6.00	6.00	5.85	6.85	5.30	5.18	5.00	5.65	6.00	5.80	6.50
2	8.40	5.98	5.85	5.85	6.50	5.28	5.08	5.00	5.55	6.75	5.72	6.25
3	7.60	5.78	5.70	5.78	6.00	5.30	5.00	5.05	5.45	6.00	5.60	6.15
4	6.60	6.10	5.58	5.90	5.78	5.22	5.00	6.05	5.32	6.35	5.52	5.90
5	6.30	5.75	5.45	8.10	5.65	5.30	5.00	5.70	5.32	6.40	5.50	5.82
6	5.98	5.55	5.55	7.70	5.55	5.30	5.00	5.58	7.05	6.15	5.52	5.80
7	6.00	5.50	5.35	8.00	5.52	5.22	5.22	5.25	7.20	5.95	6.00	5.82
8	6.00	5.68	5.55	6.60	5.48	5.20	5.08	5.72	7.70	5.88	6.50	5.98
9	6.30	5.75	5.62	6.40	5.42	5.22	5.05	5.35	6.15	5.85	5.90	6.25
10	8.40	5.65	6.80	6.30	5.42	5.20	5.10	5.30	5.78	5.75	5.68	6.65
11	8.40	5.50	6.30	6.20	5.48	5.20	5.12	5.15	5.70	5.70	5.70	6.50
12	7.70	5.50	7.40	6.15	5.22	5.20	5.08	5.10	5.62	5.72	5.85	6.55
13	7.20	5.50	6.50	5.95	5.00	5.20	5.00	5.10	5.65	5.62	6.10	7.96
14	7.10	5.65	6.80	6.00	5.42	5.20	5.00	5.10	5.60	5.52	6.10	7.00
15	7.35	6.25	6.90	6.15	5.38	5.18	4.95	5.05	5.60	5.52	6.15	7.10
16	6.35	6.10	6.50	5.95	5.38	5.12	4.95	5.55	5.60	5.55	6.10	6.75
17	6.05	8.00	6.30	5.98	5.32	5.10	5.00	5.35	5.40	5.52	6.00	6.65
18	5.88	7.80	6.00	5.45	5.35	5.10	5.30	5.25	5.42	5.62	8.40	6.45
19	5.92	7.00	5.88	5.80	5.68	5.10	5.08	5.15	5.40	5.60	6.70	6.10
20	5.92	6.40	5.92	6.00	6.10	5.10	5.30	5.05	5.40	5.60	6.50	5.85
21	6.10	6.30	6.00	5.98	5.40	5.05	5.22	5.00	5.32	5.52	6.40	5.88
22	6.10	5.98	6.55	6.00	5.32	5.00	5.18	5.10	5.32	5.42	6.25	5.98
23	6.00	5.78	6.80	5.85	5.30	5.15	5.18	5.12	5.32	5.62	6.20	6.90
24	5.60	5.80	6.00	5.82	5.32	5.15	5.10	5.12	5.22	5.65	6.75	6.20
25	5.70	5.82	5.82	5.68	5.35	5.10	5.10	5.30	5.48	5.60	6.45	6.05
26	5.75	6.15	6.30	5.62	5.32	5.12	5.15	5.35	5.38	5.62	6.25	6.00
27	6.20	6.70	7.55	5.55	5.22	5.38	5.10	5.45	5.30	5.58	6.10	6.40
28	7.90	6.10	7.15	5.55	5.28	5.65	5.10	6.85	5.32	5.60	6.10	5.92
29	6.65	.....	6.40	5.50	5.25	5.45	5.12	7.50	5.30	5.48	7.05	6.45
30	6.25	.....	6.30	5.62	5.22	5.22	5.10	6.20	5.38	5.40	6.70	6.05
31	6.00	.....	6.10	.....	5.22	.....	5.00	5.75	.....	5.48	.....	6.00

NOTE.—Some uncertainty exists regarding the extent of backwater from ice at this station. Ice jams were frequent during January, and probably the relation of gage height to discharge was more or less affected by ice during the greater portion of February and March.

STREAMS TRIBUTARY TO LAKE ONTARIO.

GENESEE RIVER AND TRIBUTARIES.

GENESEE RIVER AT ST. HELENA, N. Y.

Location.—At the steel highway bridge about 6 miles above the mouth of Silver Lake outlet (coming in from the left), 9½ miles above Canaseraga Creek (coming in from the right), and 5½ miles below the village of Portageville and the site of the proposed storage dam of the State Water Supply Commission of New York.

Records available.—August 14, 1908, to December 31, 1911. Published also in annual reports of the State Water Supply Commission of New York, 1910, report of the New York State engineer and surveyor, and First Annual Report of the Conservation Commission of New York.

Drainage area.—1,030 square miles.

Gage.—Chain, fastened to the upstream side of the bridge, middle span; read twice daily; datum unchanged. Since August 24, 1911, a Gurley self-recording gage with intake pipe to the well a few feet downstream from the chain gage; datum same as chain gage, but slope of water surface makes readings different.

Channel.—Gravel and rocks; considered permanent.

Discharge measurements.—At high stages made from the bridge; at low and medium stages, either by wading or from the bridge.

Winter flow.—Relation between gage height and discharge, usually but slightly affected by ice; determination of winter discharge considered good.

Accuracy.—Discharge rating curve well defined and data as published considered excellent.

Cooperation.—Established and maintained by the United States Geological Survey in cooperation with the State Water Supply Commission of New York.

Discharge measurements of Genesee River at St. Helena, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 27[a]	C. C. Covert	3.56	1,180
Aug. 16	C. S. De Golyer	2.60	552
19	W. G. Hoyt	2.06	216
22	C. S. De Golyer	1.46	53.7
23[b]	W. G. Hoyt	1.45	55.6
Sept. 20	do	[c]2.30	350

[a] Ice reduces discharge about 10 per cent.
[b] Measurement made by wading above bridge.
[c] Automatic gage height 2.26 feet.

Daily gage height, in feet, of Genesee River at St. Helena, N. Y., for 1911.

(Chain gage.)

[Herman Piper, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	4.50	3.50	3.80	3.75	3.30	2.80	2.11	1.71
2	5.20	3.45	3.70	3.15	4.40	2.46	1.95	1.74
3	7.20	3.30	3.40	3.50	3.80	2.55	1.98	1.72
4	5.20	3.30	3.10	3.60	3.50	2.28	1.96	1.86
5	4.30	3.10	2.78	5.40	3.25	2.39	1.76	2.60
6	3.65	2.80	3.05	6.40	3.10	2.34	1.88	2.06
7	3.70	2.48	3.10	7.40	3.00	3.10	1.84	2.70
8	3.70	2.70	2.80	5.60	3.40	2.65	1.85	2.06
9	3.70	3.05	2.90	4.90	2.75	2.49	1.58	1.96
10	3.35	3.00	4.00	5.20	2.70	2.39	1.61	1.80
11	3.50	2.80	5.10	4.70	2.75	2.28	1.76	1.70
12	6.00	2.70	6.00	4.40	2.70	2.36	1.51	1.75
13	5.20	2.80	6.10	4.00	2.70	5.60	1.80	1.58
14	5.40	2.70	5.70	4.00	2.50	4.20	1.80	1.82
15	6.60	2.70	5.60	4.60	2.44	3.35	1.68	1.50
16	4.80	3.05	4.20	4.10	2.45	3.05	1.60	2.42
17	4.20	3.00	4.00	4.10	2.50	2.80	1.82	2.18
18	3.80	6.80	3.90	3.90	2.55	2.60	1.94	2.05
19	3.80	5.60	3.30	3.75	2.80	2.55	1.96	2.06
20	3.60	4.50	3.50	4.70	2.80	2.41	2.02	1.72
21	3.50	4.00	3.35	4.70	2.70	2.31	2.01	1.95
22	3.65	3.70	4.50	4.60	2.60	2.21	1.91	1.72
23	3.20	4.90	5.70	4.40	2.49	2.29	1.86	1.70
24	2.88	4.80	4.40	4.20	3.30	2.26	1.89	1.68
25	2.95	3.80	3.75	3.80	2.95	2.18	2.06	.....
26	2.90	3.70	4.30	3.60	2.55	2.18	1.62	.....
27	3.35	4.90	7.00	3.40	2.42	2.26	1.70	.....
28	7.10	4.60	6.70	3.25	2.41	2.40	1.65	.....
29	5.20	.....	4.80	3.10	2.22	2.28	1.91	.....
30	5.10	.....	4.30	3.06	2.08	2.18	1.51	.....
31	4.00	.....	4.00	.....	2.26	.....	1.74	.....

NOTE.—Gage heights Jan. 1 to Aug. 24 referred to chain gage. Effect of backwater from ice somewhat uncertain from January to March, but the relation of gage height to discharge was probably little affected by ice except Jan. 7 to 11, 19 to 27, Feb. 23 to 26, and Mar. 6 to 7. Gage readings were to water surface. Probably no backwater from ice during December.

Daily gage heights, by automatic and chain gages, of Genesee River at St. Helena, N. Y., for Aug. 25 to Dec. 28, 1911.

Day.	August.		September.		October.		November.		December.	
	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.
1	.....	.....	2.75	2.80	2.68	2.79	2.97	3.10	3.44	3.65
2	.....	.....	2.59	2.60	4.14	4.50	2.94	3.02	3.28	3.35
3	.....	.....	2.46	2.55	3.69	3.65	2.75	2.81	3.17	3.28
4	.....	.....	2.35	2.30	3.40	3.49	2.64	2.68	2.96	2.96
5	.....	.....	2.21	2.25	4.03	4.02	2.57	2.61	3.00	3.09
6	.....	.....	3.87	4.70	3.34	3.26	2.53	2.59	2.96	2.89
7	.....	.....	3.71	3.70	5.14	5.66	2.88	2.91	2.88	2.94
8	.....	.....	4.07	4.60	4.31	4.25	3.98	4.10	2.92	3.01
9	.....	.....	3.36	3.45	3.62	3.69	3.48	3.46	3.80	3.54
10	.....	.....	3.24	3.35	3.29	3.31	3.11	3.18	4.02	4.14
11	.....	.....	3.03	3.10	3.21	3.29	3.00	3.08	3.68	3.82
12	.....	.....	2.90	3.00	3.31	3.36	2.93	2.98	4.18	3.72
13	.....	.....	2.94	3.00	3.10	3.11	3.26	3.54	6.27	6.60
14	.....	.....	2.64	2.70	2.90	2.94	3.22	3.28	4.98	5.26
15	.....	.....	2.50	2.55	2.75	2.76	3.14	3.21	4.88	4.88
16	.....	.....	2.55	2.40	2.67	2.66	3.22	3.21	4.85	4.61
17	.....	.....	2.54	2.55	2.59	2.64	3.12	3.20	4.81	5.05
18	.....	.....	2.41	2.36	2.66	2.74	5.46	5.24	4.12	4.30
19	.....	.....	2.30	2.36	2.92	3.00	4.36	4.64	3.73	3.82
20	.....	.....	2.26	2.29	2.76	2.76	3.82	4.18	3.40	3.34

Daily gage heights, by automatic and chain gages, of Genesee River at St. Helena, N. Y., for Aug. 25 to Dec. 28, 1911—Continued.

Day.	August.		September.		October.		November.		December.	
	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.
21	.....	.....	2.23	2.26	2.64	2.68	3.63	3.66	3.31	3.38
22	.....	.....	2.18	2.20	2.57	2.60	3.43	3.52	3.28	3.38
23	.....	.....	2.15	2.19	2.56	2.62	3.31	3.36	4.11	4.22
24	.....	.....	2.08	2.16	2.60	2.62	3.88	3.79	3.71	3.85
25	1.81	1.75	2.11	2.11	2.54	2.55	3.79	3.94	3.38	3.46
26	1.96	1.96	2.11	2.16	2.45	2.49	3.49	3.59	3.32	3.29
27	1.97	1.86	2.13	2.14	2.42	2.48	3.35	3.38	3.83	3.88
28	3.72	3.60	2.09	2.08	2.41	2.49	4.27	3.76	3.39	3.52
29	5.78	5.70	2.16	2.20	2.37	2.36	4.84	5.46	.....	2.84
30	3.86	3.65	2.59	2.70	2.36	2.45	3.78	4.05	.....	3.01
31	3.08	3.15	.....	.....	2.38	2.45	.....	.....	.....	3.18

NOTE.—For the purpose of comparison gage heights for Aug. 25 to Dec. 28 are published for both the chain and automatic gages. It should be noted that, as the mouth of the intake pipe to the automatic gage is located a few feet downstream from the chain gage, the gage readings do not agree exactly, owing to slope, and that the slope varies with the stage. The daily gage heights for the automatic gage are the mean of 24 readings taken at hourly intervals, intermediate 15-minute readings being neglected. The daily chain-gage readings are the mean of two readings which are usually taken at 8 a. m. and 5 p. m.

Daily discharge, in second-feet, of Genesee River at St. Helena, N. Y., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	2,690	1,300	1,660	1,600	1,100	663	237	108
2	4,020	1,250	1,530	961	2,530	421	178	116
3	9,680	1,100	1,200	1,300	1,660	480	188	110
4	4,020	1,100	916	1,410	1,300	317	182	150
5	2,370	916	648	4,470	1,050	377	121	514
6	1,470	663	600	7,120	916	349	156	218
7	1,200	433	600	10,400	828	916	144	587
8	1,100	587	663	4,950	1,200	550	147	218
9	1,100	872	743	3,400	625	440	77	182
10	1,000	828	1,930	4,020	587	377	83	132
11	1,100	663	3,810	3,030	625	317	121	105
12	5,990	587	5,990	2,530	587	361	63	118
13	4,020	663	6,260	1,930	587	4,950	132	77
14	4,470	587	5,200	1,930	446	2,220	132	138
15	7,720	587	4,950	2,860	408	1,150	100	61
16	3,210	872	2,220	2,070	414	872	81	396
17	2,220	828	1,930	2,070	446	663	138	268
18	1,660	8,340	1,790	1,790	480	514	175	214
19	1,200	4,950	1,100	1,600	663	480	182	218
20	900	2,690	1,300	3,030	663	389	203	110
21	800	1,930	1,150	3,030	587	333	199	178
22	700	1,530	2,690	2,860	514	282	165	110
23	700	1,200	5,200	2,530	440	322	150	105
24	650	1,100	2,530	2,220	1,100	307	159	100
25	600	1,000	1,600	1,660	786	268	218	.....
26	650	1,000	2,370	1,410	480	268	86	.....
27	1,000	3,400	8,980	1,200	396	307	105	.....
28	9,330	2,860	8,030	1,050	389	383	93	.....
29	4,020	.....	3,210	916	287	317	165	.....
30	3,810	.....	2,370	881	225	268	63	.....
31	1,930	.....	1,930	.....	307	.....	116	.....

NOTE.—Daily discharge determined from a well-defined discharge rating curve. Discharge for the periods during which relation of gage height to discharge was affected by ice Jan. 7 to 11, 19 to 27, Feb. 23 to 26, and Mar. 6 to 7 estimated from climatologic records and the discharge at Rochester.

Daily discharge, in second-feet, from automatic and chain gages, of Genesee River at St. Helena, N. Y., for Aug. 25 to Dec. 28, 1911.

Day.	August.		September.		October.		November.		December.	
	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.
1	.....	.....	663	663	602	655	846	916	1,320	1,470
2	.....	.....	536	514	2,280	2,690	820	846	1,150	1,150
3	.....	.....	446	480	1,620	1,470	663	671	1,030	1,080
4	.....	.....	372	327	1,280	1,290	572	572	837	794
5	.....	.....	297	302	2,120	1,960	521	521	881	907
6	.....	.....	1,870	3,030	1,210	1,060	493	507	837	735
7	.....	.....	1,660	1,530	4,200	5,100	768	752	768	777
8	.....	.....	2,180	2,860	2,560	2,300	2,040	2,070	802	837
9	.....	.....	1,230	1,250	1,530	1,520	1,370	1,260	1,780	1,340
10	.....	.....	1,110	1,150	1,160	1,110	979	988	2,100	2,130
11	.....	.....	907	916	1,080	1,090	881	898	1,610	1,690
12	.....	.....	786	828	1,180	1,160	811	811	2,340	1,560
13	.....	.....	820	828	970	925	1,130	1,340	7,300	7,720
14	.....	.....	572	587	785	777	1,090	1,080	3,850	4,150
15	.....	.....	473	480	663	633	1,010	1,020	3,620	3,360
16	.....	.....	507	383	595	558	1,090	1,020	3,560	2,880
17	.....	.....	500	480	536	543	988	1,010	3,480	3,620
18	.....	.....	414	361	587	617	5,000	4,110	2,250	2,370
19	.....	.....	344	361	802	828	2,640	2,930	1,690	1,690
20	.....	.....	322	322	671	633	1,800	2,190	1,280	1,140
21	.....	.....	307	307	572	572	1,540	1,480	1,180	1,180
22	.....	.....	277	277	521	514	1,310	1,320	1,150	1,180
23	.....	.....	264	273	514	529	1,180	1,160	2,240	2,250
24	.....	.....	233	259	543	529	1,890	1,650	1,660	1,720
25	138	118	246	237	500	480	1,750	1,850	1,250	1,260
26	188	182	246	259	440	440	1,380	1,400	1,190	1,090
27	192	150	307	251	421	433	1,220	1,180	1,820	1,760
28	1,670	1,410	237	226	414	440	2,500	1,610	1,260	1,360
29	5,860	5,200	268	277	383	361	3,540	4,610	.....	695
30	1,860	1,470	536	587	379	414	1,750	2,000	.....	837
31	961	961	.....	.....	389	414	.....	.....	.....	988
Mean	1,550	1,360	631	687	1,020	1,030	1,450	1,460	1,830	1,800

NOTE.—Daily discharge Aug. 25 to Dec. 31 determined from a well-defined discharge rating curve based on measurements referred to the chain gage, the same rating curve being used for both sets of gage heights. The daily discharge was determined for the automatic gage record from the chain-gage rating by means of the following well-defined table of relation, which serves to reduce the automatic-gage readings to the corresponding chain-gage readings. Discharge Dec. 29 to 31 taken from chain-gage record; automatic-gage not running. Except for errors caused by diurnal fluctuations of stage and inaccuracies of observation, the determinations should be strictly comparable. The determinations referred to the automatic gage should, of course, be given preference.

Table for Genesee River at St. Helena, N. Y., changing automatic to chain gage heights for 1911.

Auto.	Chain.	Auto.	Chain.	Auto.	Chain.	Auto.	Chain.
Feet.		*Feet.*		*Feet.*		*Feet.*	
1.80	1.81	3.80	3.89	5.80	5.97	7.80	8.05
1.90	1.92	3.90	4.00	5.90	6.08	7.90	8.16
2.00	2.02	4.00	4.10	6.00	6.18	8.00	8.26
2.10	2.12	4.10	4.20	6.10	6.28	.....	.....
2.20	2.23	4.20	4.31	6.20	6.39	.....	.....
2.30	2.33	4.30	4.41	6.30	6.49	.....	.....
2.40	2.44	4.40	4.52	6.40	6.60	.....	.....
2.50	2.54	4.50	4.62	6.50	6.70	.....	.....
2.60	2.64	4.60	4.72	6.60	6.80	.....	.....
2.70	2.75	4.70	4.83	6.70	6.91	.....	.....
2.80	2.85	4.80	4.93	6.80	7.01	.....	.....
2.90	2.95	4.90	5.04	6.90	7.12	.....	.....
3.00	3.06	5.00	5.14	7.00	7.22	.....	.....
3.10	3.16	5.10	5.24	7.10	7.32	.....	.....
3.20	3.27	5.20	5.34	7.20	7.43	.....	.....
3.30	3.37	5.30	5.45	7.30	7.53	.....	.....
3.40	3.48	5.40	5.56	7.40	7.64	.....	.....
3.50	3.58	5.50	5.66	7.50	7.74	.....	.....
3.60	3.68	5.60	5.76	7.60	7.84	.....	.....
3.70	3.79	5.70	5.87	7.70	7.95	.....	.....

Monthly discharge of Genesee River at St. Helena, N. Y., for 1911.

[Drainage area, 1,030 square miles.]

Month.	Discharge in second-feet.										Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.						Minimum.	Mean.		Per square mile.		
	Automatic gage.				Chain gage.			Automatic gage.	Chain gage.			
	Day.	Hour.	Crest gage heights.	Crest discharge.	Day.	24-hour discharge.						
Jan.	.....	.....	.....	.....	.....	9,680	600	.....	2,750	2.67	3.08	C.
Feb.	.....	.....	.....	.....	.....	8,340	433	.....	1,570	1.52	1.58	B.
Mar.	.....	.....	.....	.....	.....	8,980	600	.....	2,750	2.67	3.08	A.
Apr.	.....	.....	.....	.....	.....	10,400	881	.....	2,670	2.59	2.89	A.
May	.....	.....	.....	.....	.....	2,530	225	.....	730	.709	.82	A.
June	.....	.....	.....	.....	.....	4,950	268	.....	662	.643	.72	A.
July	.....	.....	.....	.....	.....	237	63	.....	141	.137	.16	B.
Aug.	28	9.15 p. m.	7.92	12,600	29	5,200	61	a 497	452	b. 482	.56	A.
Sept.	8	11.30 a. m.	5.30	4,240	6	3,030	c 233	631	687	b. 613	.68	A.
Oct.	7	11.30 a. m.	6.08	6,210	7	5,100	c 379	1,020	1,030	b. 991	1.14	A.
Nov.	18	10.30 a. m.	6.44	7,240	29	4,610	c 493	1,450	1,460	b 1.41	1.57	A.
Dec.	13	6 a. m.	6.70	8,030	13	7,720	695	a 1,830	1,800	b 1.78	2.05	A.
The year.	Aug. 28	9.15 p. m.	7.92	12,600	.....	10,400	61	a 1,390	1,390	b 1.35	18.33	

a Missing records Jan. 1 to Aug. 24 and Dec. 29 to 31 completed from chain gage record.
b Computed from mean monthly discharge in automatic gage column.
c From automatic gage record.

NOTE.—In computing the monthly mean for August and December, and the annual mean, the automatic gage records have been used as far as available, as they are considered preferable. For comparison, the 24-hour maximum for the chain gage and the monthly means for the chain gage are presented in the table above for the period Aug. 25 to Dec. 31.

GENESEE RIVER AT JONES BRIDGE, NEAR MOUNT MORRIS, N. Y.

Location.—At the highway bridge known as Jones Bridge, about 5 miles below the village of Mount Morris, 6 miles by river above the village of Genesee, 1¾ miles below the inflow of Canesaraga Creek (coming in from the right) and about 1¾ miles above the mouth of Beads Creek (coming in from the left).

Records available.—May 22, 1903, to April 30, 1906; Aug. 12, 1908, to Dec. 31, 1911. Published also in reports of State engineer and surveyor of New York, State Water Supply Commission of New York, and Conservation Commission of New York.

Drainage area.—1,410 square miles.

Gage.—Chain, fastened to upstream side of highway bridge; read twice daily; datum unchanged since established.

Channel.—Clay; liable to shift, but measurements have shown it to be fairly permanent in recent years.

Discharge measurements.—Made at all stages from footbridge erected on the outriggers of the bridge.

Winter flow.—Relation between gage height and discharge for the winter months considerably affected by ice. Volume of flow during the winter months determined chiefly by comparison with the flow of the Genesee at Rochester and at St. Helena.

Accuracy.—Discharge curve well developed and data as published for open-water periods believed to be excellent.

Cooperation.—Established by United States Geological Survey in 1903 in cooperation with the State engineer of New York; reestablished in 1908 in cooperation with the State Water Supply Commission of New York.

Discharge measurements of Genesee River at Jones Bridge, near Mount Morris, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 15	C. C. Covert	14.00	6,590
30	W. G. Hoyt	9.92	3,750
Aug. 28	Frank Weber	4.36	393
28	C. S. De Golyer	5.16	814

Daily gage height, in feet, of Genesee River at Jones Bridge, near Mount Morris, N. Y., for 1911.

[Elizabeth Trewer, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	11.4	13.1	13.8	8.2	6.2	4.3	3.95	3.6	5.5	5.5	5.1	6.7
2	12.4	12.5	13.6	7.4	8.8	4.6	3.8	3.6	4.95	7.0	5.5	6.2
3	22.3	11.6	12.4	7.0	7.5	4.6	3.85	3.5	4.75	7.5	5.2	5.9
4	18.6	11.2	11.4	7.0	6.7	4.55	4.0	3.6	4.5	8.1	5.1	5.52
5	14.1	10.9	11.0	10.2	6.2	4.3	3.7	3.85	4.35	6.9	4.76	5.6
6	13.2	.....	10.0	16.7	6.0	4.55	3.7	4.3	6.5	6.6	4.8	5.6
7	13.1	10.4	9.2	19.1	5.7	4.5	3.7	3.9	7.8	8.0	4.95	5.5
8	13.2	.....	8.5	14.9	5.5	5.1	3.6	3.8	8.6	6.9	7.4	5.6
9	12.8	.....	9.1	11.2	5.4	4.65	3.55	3.85	6.7	6.4	6.5	5.8
10	12.4	.....	14.4	11.1	5.3	4.55	3.6	3.6	5.9	6.2	5.8	8.0
11	11.8	9.4	16.0	10.0	5.2	4.4	3.6	3.6	5.7	6.0	5.4	7.2
12	15.0	.....	18.4	9.1	5.2	4.45	3.45	3.45	5.4	6.2	5.4	6.7
13	20.1	.....	20.4	8.3	4.9	7.7	3.35	3.25	5.5	5.8	6.0	14.4
14	19.5	.....	17.7	7.8	4.85	7.9	3.55	3.45	5.1	5.4	6.0	13.2
15	22.3	.....	14.7	8.5	4.65	6.1	3.35	3.35	4.8	5.2	5.8	10.1
16	19.4	9.5	9.3	7.8	4.75	5.4	3.2	3.65	4.7	5.0	5.7	10.7
17	16.3	9.8	8.8	8.0	4.8	5.0	3.75	4.25	4.85	5.0	5.7	10.9
18	14.8	17.8	7.8	7.7	4.8	4.95	4.0	3.85	4.55	5.2	8.5	9.1
19	13.9	22.4	7.3	7.2	4.8	4.65	3.7	3.9	4.5	5.4	10.4	7.6
20	13.0	18.5	6.95	8.5	5.3	4.5	3.7	3.75	4.3	5.2	7.6	6.8
21	12.4	16.6	7.7	10.5	5.0	4.3	3.7	3.6	4.2	5.0	7.1	6.5
22	12.2	15.1	8.9	8.2	4.65	4.2	3.7	3.55	4.2	4.85	6.6	6.2
23	11.2	14.6	11.8	8.0	4.75	4.2	3.55	3.3	4.15	4.8	6.2	7.0
24	12.1	14.5	9.1	7.6	5.7	4.2	3.6	3.4	4.05	4.8	6.6	7.6
25	11.8	14.4	7.7	7.0	5.5	4.1	3.7	3.65	4.0	4.8	7.7	6.6
26	11.3	14.2	8.4	6.6	4.85	4.15	3.75	3.6	4.1	4.7	6.7	6.3
27	11.8	14.4	16.8	6.1	4.7	4.15	3.5	3.8	4.1	4.6	6.4	7.0
28	21.8	14.0	19.3	6.0	4.4	4.3	3.5	4.5	4.1	4.55	6.8	7.1
29	20.4	.....	11.5	5.75	4.3	4.45	3.45	15.4	4.15	4.51	11.0	5.6
30	15.4	.....	9.8	5.75	4.15	4.1	3.5	8.2	4.4	4.51	8.0	6.7
31	13.7	.....	8.8	.....	4.05	.....	3.5	6.7	.....	4.51	.....	7.1

NOTE.—Gage heights at this station during each winter period greatly affected by backwater from ice jams. It is probable that the relation of gage height to discharge was affected from this cause from about Jan. 1 to about Mar. 11. Gage readings were probably to water surface . Probably no backwater during December.

Daily discharge, in second-feet, of Genesee River at Jones Bridge, near Mount Morris, N. Y., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,000	2,530	1,340	410	282	175	960	960	760	1,620
2	2,400	2,030	2,920	530	235	175	688	1,790	960	1,340
3	1,900	1,790	2,090	530	250	150	598	2,090	810	1,180
4	1,500	1,790	1,620	510	300	175	490	2,460	760	970
5	1,200	3,890	1,340	410	205	250	430	1,730	602	1,010
6	1,000	8,920	1,230	510	205	410	1,500	1,560	620	1,010
7	900	10,800	1,060	490	205	265	2,270	2,400	688	960
8	950	7,480	960	760	175	235	2,790	1,730	2,030	1,010
9	1,000	4,590	910	552	162	250	1,620	1,450	1,500	1,120
10	2,500	4,520	860	510	175	175	1,180	1,340	1,120	2,400
11	5,000	3,750	810	450	175	175	1,060	1,230	910	1,910
12	10,300	3,120	810	470	138	138	910	1,340	910	1,620
13	11,900	2,600	665	2,210	112	90	960	1,120	1,230	7,080
14	9,720	2,270	642	2,340	162	138	760	910	1,230	6,120
15	7,320	2,720	552	1,280	112	112	620	810	1,120	3,820
16	3,260	2,270	598	910	80	190	575	710	1,060	4,240
17	2,920	2,400	620	710	220	390	642	710	1,060	4,380
18	2,270	2,210	620	688	300	250	510	810	2,720	3,120
19	1,970	1,910	620	552	205	265	490	910	4,030	2,150
20	1,760	2,720	860	490	205	220	410	810	2,150	1,670
21	2,210	4,100	710	410	205	175	370	710	1,850	1,500
22	2,980	2,530	552	370	205	162	370	642	1,560	1,340
23	5,020	2,400	598	370	162	100	352	620	1,340	1,790
24	3,120	2,150	1,060	370	175	125	318	620	1,500	2,150
25	2,210	1,790	960	335	205	190	300	620	2,210	1,560
26	2,660	1,560	642	352	220	175	335	575	1,620	1,400
27	9,000	1,280	575	352	150	235	335	530	1,450	1,790
28	11,000	1,230	450	410	150	490	335	510	1,670	1,850
29	4,800	1,090	410	470	138	7,880	352	494	4,450	1,010
30	3,610	1,090	352	335	150	2,530	450	494	2,400	1,620
31	2,920	.....	318	.....	150	1,620	.....	494	.....	1,950

NOTE.—Daily discharge determined from a well-defined discharge rating curve. Discharge Mar. 1 to 11 estimated from the determination of discharge at St. Helena and at Rochester.

Monthly discharge of Genesee River at Jones Bridge, near Mount Morris, N. Y., for 1911.

[Drainage area, 1,410 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	3,500	2.48	2.86	C.
February	.....	.....	2,200	1.56	1.62	C.
March	11,900	900	3,950	2.80	3.23	A.
April	10,800	1,090	3,120	2.21	2.47	A.
May	2,920	318	897	.636	.73	A.
June	2,340	335	637	.452	.50	A.
July	300	80	187	.133	.15	B.
August	7,880	90	577	.409	.47	A.
September	2,790	300	767	.544	.61	A.
October	2,460	494	1,070	.759	.88	A.
November	4,450	602	1,550	1.10	1.23	A.
December	7,080	960	2,150	1.52	1.75	A.
The year	11,900	80	1,710	1.21	16.50	

NOTE.—Monthly discharge for January and February computed from the discharge at St. Helena and Rochester, with due consideration of the relative drainage areas.

GENESEE RIVER AT ROCHESTER, N. Y.

Location.—At the highway bridge known locally as Elmwood Avenue Bridge, at the north end of South Park, 3½ miles above the center of the city of Rochester, 3¼ miles below the mouth of Black Creek (coming in from the left), and 7½ miles above the mouth of the river.

Records available.—February 9, 1904, to December 31, 1911; published also in annual reports of the State engineer and surveyor, the State Water Supply Commission, and the Conservation Commission of the State of New York. Elevation of water surface, measurements, and records of flow of Genesee River at Rochester during flood stages, and low water previous to 1904, published in annual reports of the State engineer and surveyor, 1902–3–4, and in Water-Supply Papers 24, 65, and 97.

Drainage area.—2,360 square miles.

Gage.—Prior to 1910 a staff gage bolted to the downstream end of the first pier from the right-hand abutment was read once daily. From December, 1910, to December, 1911, mean gage heights computed from a Gurley recording gage in the pump house immediately below the bridge on the right-hand bank. Elevation of zero of gage, 506.848 Barge Canal datum and 245.591 Rochester City datum. Gage datum unchanged since installation of the station.

Channel.—Gravel, smooth; considered permanent.

Discharge measurements.—Made from bridge at which the staff gage is located. Prior to 1904 measurements and elevations of water surface taken in conjunction with the water flowing over and around Johnson-Seymour dam in the city of Rochester.

Winter flow.—Affected by ice for short periods, although, as a rule, the channel is open.

Accuracy.—Discharge rating curve well developed for all stages; published data considered good for periods of open water.

Cooperation.—Maintained by the United States Geological Survey in cooperation with the New York State Barge Canal and the engineer department of the city of Rochester from 1904 to 1909; from December, 1909, maintained in cooperation with the State Water Supply Commission of New York.

Discharge measurements of Genesee River at Rochester, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 29	W. G. Hoyt	6.79	13,800
29	do	6.36	13,100
Apr. 1	do	3.43	4,300
Aug. 14[a]	C. S. DeGolyer	1.03	219
14[a]	W. G. Hoyt	1.02	226
29	Frank Weber	1.18	470
Sept. 21	W. G. Hoyt	1.16	501

[a] Temporary earth dam below station caused backwater.

Daily gage height, in feet, of Genesee River at Rochester, N. Y., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.55	3.84	4.42	3.26	2.28	1.49	1.3	1.3	1.89	1.18	1.34	2.87
2	3.62	3.31	3.83	3.02	2.48	1.52	1.3	1.3	1.58	1.42	1.56	2.44
3	4.08	2.76	3.30	2.87	2.57	1.56	1.3	1.3	1.45	2.38	1.75	2.18
4	4.99	2.46	2.94	2.80	2.58	1.57	1.3	1.3	1.32	2.31	1.64	2.01
5	5.15	2.30	2.75	3.69	2.43	1.53	1.2	1.3	1.27	2.04	1.56	1.85
6	3.82	2.41	2.40	6.37	2.24	1.58	1.2	1.3	1.29	2.46	1.47	1.84
7	2.88	2.60	2.20	6.67	2.08	1.77	1.2	1.2	2.11	2.19	1.48	1.83
8	2.65	2.62	2.04	6.60	1.93	1.70	1.4	1.2	2.33	3.65	1.57	1.79
9	2.75	2.43	2.09	4.80	1.87	1.85	1.7	1.2	2.69	3.14	2.49	1.77
10	2.97	1.99	2.89	4.40	1.84	1.73	1.7	1.1	2.22	2.64	2.29	2.14
11	2.63	2.22	4.29	4.29	1.68	1.56	1.7	1.1	1.93	2.07	2.01	2.77
12	2.98	1.94	5.34	4.06	1.29	1.49	1.6	1.1	1.83	1.99	1.84	2.55
13	4.14	1.72	6.43	3.66	1.4	2.03	1.6	1.1	1.67	2.04	1.78	3.11
14	4.81	1.68	6.83	3.36	1.79	3.05	1.5	1.1	1.68	1.89	2.00	5.43
15	4.77	2.31	6.65	3.26	1.75	2.41	1.5	1.1	1.52	1.73	2.04	4.71
16	5.48	2.20	5.56	3.54	1.74	2.05	1.5	1.1	1.40	1.59	1.94	4.13
17	4.60	1.68	3.84	3.29	1.72	1.84	1.5	1.1	1.33	1.53	1.93	4.10
18	3.56	3.02	3.37	3.18	1.73	1.65	1.5	1.1	1.31	1.48	1.94	4.00
19	3.09	5.50	3.13	3.04	1.74	1.55	1.5	1.0	1.32	1.46	3.56	3.32
20	2.65	6.07	2.95	3.02	1.73	1.55	1.5	1.0	1.19	1.62	3.63	2.79
21	2.57	4.66	3.09	3.67	1.86	1.54	1.5	1.0	1.16	1.59	2.82	2.36
22	2.74	3.71	3.32	3.70	1.82	1.43	1.5	1.06	1.15	1.51	2.55	2.28
23	2.80	3.21	4.55	3.33	1.74	1.37	1.5	1.02	1.13	1.43	2.35	2.36
24	2.46	2.89	4.76	3.27	1.76	1.35	1.4	.99	1.10	1.42	2.22	3.01
25	2.08	2.76	3.51	3.10	2.09	1.40	1.4	.99	1.05	1.43	2.53	2.86
26	1.96	3.04	3.17	2.81	2.06	1.2	1.4	1.01	1.08	1.42	2.74	2.46
27	2.17	4.40	3.84	2.61	1.81	1.2	1.3	1.01	1.08	1.45	2.44	2.40
28	3.60	4.94	6.46	2.47	1.66	1.2	1.3	1.03	1.07	1.36	2.27	2.68
29	5.65	.....	6.56	2.35	1.55	1.3	1.3	2.31	1.09	1.33	2.65	2.31
30	5.67	.....	5.24	2.27	1.52	1.4	1.3	4.11	1.10	1.27	3.75	1.64
31	4.50	.....	.....	.....	1.47	.....	1.3	2.62	.....	1.32	.....	1.79

NOTE.—Daily gage heights recorded on the automatic gage, except May 13 and June 26 to Aug. 21, which were observed at 4 p. m. on the staff gage. Relation of gage height to discharge probably not materially affected by ice during the winter months. The gage heights July 8 to Aug. 28 were affected by an earth dam put in below the gage. The daily automatic gage heights are the mean of 24 records taken at hourly intervals, intermediate 15-minute readings being neglected. There is probably no difference between the automatic and staff gage heights resulting from slope in water surface.

Daily discharge, in second-feet, of Genesee River at Rochester, N. Y., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7,240	5,420	6,890	4,070	2,100	847	610	340	1,440	481	658	3,240
2	4,890	4,180	5,390	3,540	2,460	888	610	340	972	756	944	2,390
3	6,010	3,020	4,160	3,240	2,640	944	610	340	795	2,280	1,220	1,920
4	8,470	2,430	3,380	3,100	2,660	958	610	340	634	2,160	1,060	1,620
5	8,920	2,140	3,000	5,060	2,370	902	500	340	577	1,670	944	1,380
6	5,370	2,340	2,320	12,500	2,030	972	500	340	599	2,430	821	1,360
7	3,260	2,700	1,960	13,400	1,740	1,260	500	290	1,800	1,940	834	1,340
8	2,800	2,740	1,670	13,200	1,500	1,150	390	290	2,190	4,960	958	1,280
9	3,000	2,370	1,760	7,940	1,400	1,380	540	290	2,880	3,810	2,480	1,260
10	3,440	1,580	3,280	6,840	1,360	1,200	540	250	2,000	2,780	2,120	1,850
11	2,760	2,000	6,550	6,550	1,120	944	540	250	1,500	1,730	1,620	3,040
12	3,460	1,510	9,450	5,960	599	847	490	250	1,340	1,580	1,360	2,600
13	6,160	1,180	12,700	4,980	730	1,650	490	250	1,100	1,670	1,270	3,740
14	7,970	1,120	14,000	4,290	1,280	3,610	440	250	1,120	1,440	1,600	9,700
15	7,860	2,160	13,400	4,070	1,220	2,340	440	250	888	1,200	1,670	7,690
16	9,840	1,960	10,100	4,700	1,210	1,690	440	250	730	986	1,510	6,140
17	7,380	1,120	5,420	4,140	1,180	1,360	440	250	646	902	1,500	6,060
18	4,740	3,540	4,310	3,900	1,200	1,080	440	250	622	834	1,510	5,800
19	3,700	9,900	3,790	3,590	1,210	930	440	210	634	808	4,740	4,200
20	2,800	11,600	3,400	3,540	1,200	930	440	210	490	1,030	4,910	3,080

Daily discharge, in second-feet, of Genesee River at Rochester, N. Y., for 1911—Contd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	2,640	7,550	3,700	5,010	1,390	916	440	210	462	986	3,140	2,250
22	2,980	5,100	4,200	5,080	1,330	769	440	234	452	874	2,600	2,100
23	3,100	3,960	7,240	4,230	1,210	694	440	218	434	769	2,230	2,250
24	2,430	3,280	7,830	4,090	1,240	670	390	206	405	756	2,000	3,520
25	1,740	3,020	4,620	3,720	1,760	730	390	206	362	769	2,560	3,220
26	1,540	3,590	3,870	3,120	1,710	500	390	214	388	756	2,980	2,430
27	1,910	6,840	5,420	2,720	1,320	500	340	214	388	795	2,390	2,320
28	4,840	8,330	12,800	2,450	1,090	500	340	222	380	682	2,090	2,860
29	10,400	.....	13,100	2,230	930	610	340	2,160	396	646	2,800	2,160
30	10,400	.....	9,170	2,090	888	730	340	6,090	405	577	5,200	1,060
31	7,100	.....	6,620	.....	821	.....	340	2,740	.....	634	.....	1,280

NOTE.—Daily discharge determined from a well-defined discharge rating curve, except from July 8 to Aug. 28. For this period an approximate auxiliary curve has been used, constructed by means of two discharge measurements made Aug. 14 and comparisons with discharge at St. Helena and at Jones Bridge.

Monthly discharge of Genesee River at Rochester, N. Y., for 1911.

[Drainage area, 2,360 square miles.]

Month.	Maximum.				Minimum.	Mean.	Per square mile.	Run-off (depth in inches).	Accuracy.
	Day.	Hour.	Crest.	Crest.					
			Feet.	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*		
January	29	11.30 a. m.	6.28	12,200	1,540	5,130	2.17	2.50	B.
February	20	6 a. m.	6.41	12,600	1,120	3,810	1.61	1.68	B.
March	29	2 a. m.	7.07	14,700	1,670	6,310	2.67	3.08	A.
April	6	12 p. m.	6.89	14,100	2,090	5,110	2.17	2.42	A.
May	3–4	All day	2.58	2,660	599	1,450	.614	.71	A.
June	14	2.15 a. m.	3.44	4,470	500	1,080	.458	.51	A.
July	.....	.....	.....	[a] 610	340	458	.194	.22	C.
August	30	2.15 a. m.	4.63	7,460	206	590	.250	.29	C.
September	9	4.30 p. m.	3.02	3,540	362	901	.382	.43	A.
October	8	1 p. m.	3.89	5,540	481	1,410	.598	.69	A.
November	19	7 p. m.	4.37	6,760	658	2,060	.873	.97	A.
December	14	3 p. m.	5.66	10,400	1,060	3,070	1.30	1.50	A.
The year	Mar. 29	2 a. m.	7.07	14,700	206	2,610	1.11	15.00	

[a] 24-hour maximum.

CANASERAGA CREEK AT DANSVILLE, N. Y.

Location.—At the highway bridge 1 mile due west from the village of Dansville, about 2,200 feet below the mouth of Mill Brook (coming in from the right) and about 22 miles above the mouth of the creek.

Records available.—July 21, 1910, to December 31, 1911. Data published also in annual reports of State Water Supply Commission, State Conservation Commission, and State engineer and surveyor, State of New York.

Drainage area.—Not measured.

Gage.—Staff, bolted to the downstream side of the left-hand abutment; read twice daily; datum unchanged.

Channel.—Sand and gravel, liable to shift during high water.

Discharge measurements.—At high stages made from the bridge; low-water measurements made by wading below the bridge.

Winter flow.—The relation of gage height to discharge is affected by ice.

Accuracy.—Discharge rating curve not sufficiently developed to warrant the publication of table of daily discharge.

Cooperation.—Established by United States Geological Survey in cooperation with the State Water Supply Commission of New York.

Discharge measurements of Canaseraga Creek at Dansville, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 31	W. G. Hoyt	2.50	242
Aug. 28[a]	Frank Weber	1.77	26.9

[a] Measurement made by wading above bridge.

Daily gage height, in feet, of Canaseraga Creek at Dansville, N. Y., for 1911.

[Floyd Harter, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1			3.20	2.18	2.32	2.18	1.80	1.60	2.22	2.06	2.09	2.24
2			3.20	2.05	2.55	2.18	1.78	1.60	1.96	2.20	2.06	2.19
3			2.95	2.10	2.42	2.05	1.75	1.62	1.94	1.99	2.03	2.22
4			2.78	2.12	2.32	1.98	1.70	1.82	1.81	2.06	1.92	2.24
5			2.88	3.08	2.28	2.10	1.62	1.73	1.98	2.03	1.99	2.12
6			2.80	3.05	2.20	2.08	1.68	1.70	1.98	1.92	2.01	2.16
7			2.55	3.85	2.12	1.98	1.70	1.68	1.84	2.89	2.18	2.19
8			2.58	3.40	2.15	2.02	1.68	1.72	2.24	2.74	2.02	2.24
9			2.78	2.92	2.12	1.92	1.72	1.68	2.06	2.74	2.29	2.18
10			3.15	2.82	2.02	1.90	1.70	1.60	1.89	2.51	2.16	2.32
11			3.40	2.72	2.02	2.05	1.72	1.68	1.81	2.24	2.08	2.24
12			3.65	2.52	1.98	2.20	1.70	1.60	1.88	2.26	2.19	2.36
13			3.90	2.45	1.92	2.28	1.72	1.62	1.94	2.12	2.20	3.20
14			4.20	2.60	1.92	2.18	1.70	1.60	1.84	2.04	2.18	2.95
15			4.20	2.48	1.90	2.05	1.65	1.80	1.81	2.04	2.26	2.69
16			3.45	2.32	1.82	1.95	1.70	2.10	1.82	1.96	2.18	2.95
17		2.33	3.15	2.45	2.02	1.88	2.05	1.88	1.82	1.92	2.29	2.91
18		3.40	3.30	2.40	2.05		1.95	1.98	1.80	2.04	2.91	2.69
19		3.60	3.30	2.30	1.92	1.82	1.82	1.88	1.88	1.94	2.59	2.64
20		3.40	3.05	2.48	1.92	1.80	1.98	1.72	1.86	1.88	2.50	2.29
21		3.05	2.78	2.40	1.95	1.82	1.80	1.70	1.79	1.89	2.31	2.11
22		2.82	2.78	2.45	1.92	1.88	1.78	1.72	1.78	1.96	2.24	2.20
23		2.35	2.75	2.62	1.95	1.82	1.75	1.72	1.81	2.01	2.18	2.59
24		2.08	2.48	2.48	2.05	1.80	1.72	1.80	1.85	1.92	2.25	2.62
25		2.45	2.88	2.32	2.18	1.82	1.70	2.02	1.84	1.94	2.21	2.49
26		2.94	2.95	2.22	2.08	1.80	1.68	1.88	1.91	1.88	2.19	2.39
27		3.40	4.15	2.12	1.98	1.88	1.65	1.72	1.82	1.99	2.18	2.81
28		3.35	3.80	2.02	1.95	2.02	1.62	2.45	1.84	1.96	2.14	2.58
29			2.82	1.90	1.82	1.92	1.62	2.50	1.92	1.92	2.39	2.41
30			2.58	1.88	1.80	1.80	1.62	2.22	1.96	1.95	2.26	2.44
31			2.35		1.95		1.60	2.20		2.14		2.75

NOTE.—No information regarding backwater from ice at this station.

KESHEQUA CREEK AT SONYEA, N. Y.

Location.—On the second highway bridge in the village of Sonyea, 4¼ miles above the junction of Canaseraga Creek and about 4 miles downstream from Tuscarora.

Records available.—July 22, 1910, to December 31, 1911. Data also in annual reports of State Water Supply Commission, New York State Conservation Commission, and State engineer and surveyor, State of New York.

Drainage area.—Not yet determined.

Gage.—Staff, fastened to a pile on the right bank directly back of and across from the Craig Colony power house; used for low-water readings. Chain gage installed October 25, 1910, on upstream side of second bridge; used for high-water readings. Gage read twice daily. The zeros of these gages are not set at the same datum.

Channel.—Sand and gravel; liable to shift at high stages.

Discharge measurements.—At high stages made from either bridge; at low stages made by wading.

Winter flow.—Relation of gage height to discharge affected by ice.

Accuracy.—Discharge rating curve not sufficiently developed to warrant publication of table of daily discharge.

Cooperation.—Established by United States Geological Survey in cooperation with State Water Supply Commission of New York.

Discharge measurements of Keshequa Creek at Sonyea, N. Y., in 1911.

Date.	Hydrographer.	Gage height.[a]	Discharge.
		Feet.	*Sec.-ft.*
Mar. 15	C. C. Covert	[b] 4.18	207
31	W. G. Hoyt	[c] 3.70	70
Aug. 26	Frank Weber	[d] 3.00	5.9

[a] Chain gage.
[b] Gage height at staff gage, 1.86.
[c] Gage height at staff gage, 1.39.
[d] Gage height at staff gage, 0.73.

Daily gage height, in feet, of Keshequa Creek at Sonyea, N. Y., for 1911.

[Elmer E. Reynolds, observer.]

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.70	3.72	3.58	3.18	2.95	2.90	3.05	3.15	3.20	3.40
2	.....	3.60	3.65	3.68	3.20	2.90	2.88	2.98	3.45	3.18	3.42
3	.....	3.60	3.75	3.68	3.20	2.95	2.92	2.95	3.20	3.15	3.32
4	.....	3.60	3.70	3.58	3.12	2.98	3.12	2.98	3.18	3.15	3.25
5	.....	3.60	4.70	3.48	3.10	2.88	3.00	3.00	3.15	3.15	3.20
6	.....	3.50	4.40	3.40	3.10	2.92	2.95	3.25	3.15	3.20	3.35
7	.....	3.45	4.30	3.48	3.10	3.00	3.00	3.12	4.18	3.42	3.35
8	.....	3.50	3.98	3.45	3.10	3.02	2.98	4.55	3.50	3.50	3.45
9	.....	3.65	3.95	3.40	3.05	2.98	2.95	4.50	3.42	3.52	3.52
10	.....	4.55	3.92	3.35	3.05	2.92	2.92	3.90	3.30	.45	3.55
11	.....	4.85	3.85	3.35	3.05	2.95	2.95	3.38	3.40	3.35	3.55
12	.....	5.10	3.70	3.35	3.10	2.95	2.92	3.45	3.42	3.35	3.88
13	.....	4.65	3.62	3.28	3.32	2.92	2.88	3.38	3.40	3.38	4.75
14	.....	4.50	3.60	3.25	3.20	2.85	2.88	3.20	3.32	3.35	3.95
15	.....	4.20	3.58	3.25	3.15	2.90	2.92	3.20	3.20	3.35	4.10
16	.....	3.95	3.55	3.25	3.10	2.88	2.95	3.05	3.20	3.40	3.95
17	5.40	3.70	3.58	3.28	3.05	3.28	2.98	3.00	3.15	3.42	4.02
18	5.35	3.65	3.60	3.25	3.05	3.20	2.95	3.00	3.20	4.15	3.75
19	4.75	3.68	3.60	3.25	3.00	2.98	2.95	3.02	3.20	4.35	3.55
20	3.90	3.70	3.60	3.20	2.98	2.95	2.92	2.98	3.20	3.50	3.35
21	3.80	3.70	3.60	3.15	3.00	2.98	2.90	2.98	3.20	3.50	3.35
22	3.80	3.98	3.60	3.12	3.00	3.00	2.90	2.98	3.25	3.50	3.38
23	3.82	3.88	3.60	3.18	3.00	3.00	2.85	3.00	3.22	3.50	4.08
24	3.78	3.82	3.58	3.50	3.00	2.98	2.80	2.98	3.20	4.52	3.58
25	3.68	3.70	3.55	3.35	2.98	2.95	3.02	2.92	3.20	4.05	3.45
26	4.25	3.72	3.55	3.30	2.92	3.00	3.08	3.00	3.18	3.50	3.45
27	4.50	4.80	3.55	3.18	2.90	3.00	3.00	3.02	3.15	3.45	3.90
28	3.85	4.18	3.50	3.10	3.05	3.00	3.35	3.05	3.15	3.52	3.60
29	.....	3.82	3.40	3.02	2.95	2.88	3.25	3.08	3.15	3.70	3.45
30	.....	3.85	3.35	3.00	2.95	2.85	3.30	3.20	3.15	3.45	3.45
31	.....	3.75	.....	3.02	.....	2.88	3.08	.....	3.22	.....	3.45

NOTE.—No information available regarding backwater from ice at this station. All gage readings for 1911 made with the chain gage except those from Mar. 4 to 16, which were made with the staff gage and reduced to the corresponding chain gage readings by means of a curve of relation between the two gages.

CANADICE LAKE OUTLET NEAR HEMLOCK, N. Y.

Location.—In outlet at foot of lake. Canadice Lake is tributary to Genesee River through Hemlock Lake outlet and Honeoye Creek.

Records available.—April, 1903, to December 31, 1911. Data also found in annual reports of the New York State engineer and surveyor and the reports of the city engineer of Rochester, N. Y.

Drainage area.—12.6 square miles, of which 0.7 square mile is lake surface.

Gage.—Hook gage; in channel above gate.

Discharge measurements.—Outlet is measured over a standard, thin-edged weir with a 5-foot crest and two-end contractions, so arranged with needle timbers at the ends that the length may be increased to 14.96 with no end contractions during high water. The weir crest stands 3 feet above the stream channel and is never submerged by backwater. Two additional rectangular gates, each 1 foot square, with three complete contractions and a forth partial contraction at the bottom, afford by-passes during high water. The depth of water on the weir is read each morning to hundredths of a foot by means of the hook gage. Each change of the gates is also noted. Corrections are made for velocity of approach for the higher stages. All computations are made by the Francis formula.

Diversions.—No water is diverted from Canadice Lake above the station.

Artificial control.—The outflow of the lake at the dam above the weir is controlled by the gates.

Winter flow.—The pool above the weir is free from ice throughout the winter.

Accuracy.—The observations and computations are made by engineers of the city engineer's office of Rochester, N. Y., under the direction of E. A. Fisher, city engineer, and John F. Skinner, principal assistant city engineer. They are considered excellent.

Monthly discharge of Canadice Lake outlet near Hemlock, N. Y., for 1911.

[Drainage area, 12.6 square miles.]

Month.	Discharge in second-feet.		Run-off (depth in inches on drainage area).	Mean elevation of lake above low water.
	Mean.	Per square mile.		
January	4.966	.394	0.45	1.529
February	5.566	.442	.46	1.828
March	9.859	.782	.90	2.210
April	10.540	.836	.93	2.489
May	3.987	.316	.36	2.411
June	4.183	.332	.37	2.402
July	3.859	.306	.35	1.905
August	3.662	.291	.34	1.211
September	3.643	.289	.32	0.959
October	3.781	.300	.35	0.816
November	4.153	.330	.37	0.701
December	4.281	.340	.39	1.152
The year	5.2066	.413	5.59	1.6344

TRIBUTARY TO OSWEGO RIVER.

ONEIDA RIVER AT CAUGHDENOY, N. Y.

Location.—At Caughdenoy, about 6 miles above the old Euclid station at Oak Orchard State dam, half a mile below the mouth of Caughdenoy Creek (which enters from the north) and 5 miles below Lake Oneida.

Records available.—August 30, 1902, to December 31, 1909 (at Euclid); January 1, 1910, to December 31, 1911 (at Caughdenoy, which replaces the Euclid station). Data published also in annual reports of New York State Engineer and Surveyor.

Drainage area.—1,377 square miles.

Gage.—Staff, about 150 feet upstream from the dam, on the right-hand side of the stream.

Discharge measurements.—Discharge measured over a masonry dam 415 feet long, completed at Caughdenoy during the summer of 1909. This dam has a practically level crest at elevation 369.4 feet, and an ogee cross section with a slope or batter on the upstream portion of the crest of 1 foot rise in 2 feet horizontal width. The downstream part of the crest is rounded, with a radius of 3.24 feet. The dis-

charge over the dam has been computed from formulas derived from United States Geological Survey experiments on a dam of ogee cross section similar in form, and a correction has been made for velocity of approach.

Diversions.—During the summer, and also to some extent during the winter, water is diverted past the left-hand end of the dam through the Caughdenoy lock. An estimate of the amount of water so diverted has been made and included in the calculated discharge of the river.

Cooperation.—Station maintained and records furnished by New York State engineer and surveyor.

Daily discharge, in second-feet, of Oneida River at Caughdenoy, N. Y., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,776	2,384	1,566	4,815	5,468	1,324	1,219	659	711	480	1,219	2,737
2	1,824	2,330	1,621	4,779	5,432	1,219	1,219	659	659	412	746	2,682
3	2,072	2,278	1,703	4,887	5,322	1,282	1,219	711	570	659	1,119	2,737
4	2,278	2,384	1,703	5,322	5,322	1,324	1,119	832	570	480	1,324	2,737
5	2,278	2,278	1,621	5,395	5,248	2,922	926	711	659	659	1,324	2,600
6	2,463	2,224	1,703	6,004	4,887	2,774	659	711	412	832	1,430	2,600
7	2,410	2,330	1,566	6,237	4,740	2,545	926	746	570	888	1,324	2,490
8	2,278	2,198	1,621	6,408	4,389	2,490	1,019	659	832	832	1,119	2,545
9	2,198	2,072	1,776	6,839	4,188	2,384	926	412	832	888	1,945	2,436
10	2,463	2,021	1,824	7,126	4,154	1,566	926	344	746	1,019	1,566	2,737
11	2,410	1,945	1,872	7,253	3,728	1,512	832	480	711	926	1,703	2,878
12	2,278	1,824	1,945	7,337	3,633	1,457	659	412	746	746	1,566	2,922
13	2,330	1,872	2,021	7,337	3,506	1,324	746	412	832	832	1,324	3,106
14	2,463	1,945	2,122	7,253	3,411	1,282	832	412	926	926	2,072	3,106
15	2,410	1,824	2,330	7,126	3,258	1,324	832	385	926	1,019	1,824	3,728
16	2,463	1,776	2,463	7,126	3,106	1,512	746	344	832	1,119	1,703	3,728
17	2,463	1,703	2,384	7,003	3,069	1,566	711	283	926	1,019	1,824	3,891
18	2,463	1,566	2,330	7,003	2,737	1,566	832	307	832	1,019	2,122	4,054
19	2,463	1,566	2,278	6,962	2,710	1,430	1,019	283	746	926	1,824	4,054
20	2,410	1,703	2,330	7,085	2,737	1,409	746	344	1,019	1,119	2,198	4,054
21	2,072	1,621	2,384	6,921	2,490	1,119	746	344	746	1,324	2,463	4,054
22	2,072	1,621	2,490	6,839	2,072	1,199	832	259	746	1,282	2,600	3,956
23	2,122	1,703	2,490	6,798	1,921	1,324	832	283	746	1,324	2,737	4,222
24	2,198	1,703	2,545	6,584	1,703	1,199	926	283	746	1,324	2,737	4,088
25	2,198	1,776	2,545	6,082	1,621	1,282	926	307	746	1,367	2,655	4,288
26	2,072	1,824	2,490	5,927	1,512	1,219	832	307	746	1,324	2,811	4,356
27	2,021	1,824	2,490	5,850	1,485	1,219	746	344	711	1,324	2,737	3,411
28	2,021	1,872	2,922	5,696	1,430	1,240	832	440	570	1,282	2,811	3,258
29	2,122	.....	3,570	5,620	1,457	1,199	832	480	480	1,282	2,436	3,411
30	1,566	.....	4,584	5,468	1,566	1,240	711	466	412	1,219	2,774	3,633
31	2,384	.....	4,506	.....	1,282	.....	659	746	.....	1,219	.....	3,924

Monthly discharge of Oneida River at Caughdenoy, N. Y., for 1911.

[Drainage area, 1,377 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	2,463	1,566	2,227	1.62	1.87
February	2,384	1,566	1,935	1.41	1.47
March	4,584	1,566	2,316	1.68	1.94
April	7,337	4,779	6,369	4.63	5.17
May	5,468	746	3,212	2.33	2.69
June	2,922	1,119	1,548	1.12	1.25
July	1,219	659	871	0.633	0.730
August	832	259	465	0.338	0.390
September	1,019	412	723	0.525	0.586
October	1,367	412	1,002	0.728	0.839
November	2,811	746	1,935	1.41	1.57
December	4,356	2,436	3,368	2.45	2.82
The year	7,337	259	2,164	1.573	21.325

SALMON RIVER AND TRIBUTARIES.

SALMON RIVER AT STILLWATER BRIDGE, NEAR REDFIELD, N. Y.

Location.—On Stillwater highway bridge 6¼ miles by road east of Altmar, one-fourth mile above the proposed dam of the Ontario Power Co., seven-eighths mile below Pennock Brook (coming in from the right), and 7 miles below the mouth of North Branch (coming in from the right).

Records available.—June 24 to Dec. 31, 1911.

Drainage area.—191 square miles.[1]

Gage.—Chain, attached to upstream side of bridge; datum unchanged since established.

Channel.—Small stone and gravel.

Discharge measurements.—Made from the bridge or by wading.

Accuracy.—Conditions for making measurements are good and records should be excellent.

Cooperation.—Station established by United States Geological Survey in cooperation with David R. Cooper, of Niagara Falls, N. Y., and State of New York Conservation Commission.

Discharge measurements of Salmon River at Stillwater Bridge, near Redfield, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 20	C. S. De Golyer	2.92	386
June 24[a]	do	1.92	138
Sept. 16[a]	G. H. Canfield	2.44	259
Oct. 8[b]	O. M. Moulton	4.07	752
19	do	4.50	977
Nov. 8	do	4.98	1,300
13[c]	do	6.07	2,150
15	C. S. De Golyer	[d] 4.38	977
21	do	[e] 4.34	933
Dec. 12[f]	O. M. Moulton	[g] 7.66	3,860

[a] Made by wading about 200 feet downstream from bridge.
[b] Bottom of weight held at 0.2 and 0.8 depth; discharge corrected by coefficient of 0.94 obtained from vertical velocity curves.
[c] Measurement made only to station 80 on bridge; remainder of discharge computed on basis of percentage of total discharge at station 80 obtained from other measurements.
[d] Staff gage below dam =1.74.
[e] Staff gage below dam =1.70.
[f] Measurement made by 0.2 and 0.8 depth method, but was not computed on this basis because the high velocities with insufficient weight made meter swing downstream. Discharge computed using velocity at 0.2 depth with coefficient of 0.85 obtained from vertical velocity curves.
[g] Staff gage below dam =3.77.

NOTE.—Angle of normal to bridge to current =20°. A coefficient of 0.94 applied to discharge of all measurements made at bridge.

Daily gage height, in feet, of Salmon River at Stillwater Bridge, near Redfield, N. Y., for 1911.

[C. A. Hall, observer.]

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.45	1.62	2.0	2.2	4.0	4.4
2	.....	2.2	1.6	1.92	2.8	3.6	4.0
3	.....	2.0	1.58	1.89	2.65	3.2	3.8
4	.....	1.9	1.6	1.76	3.5	3.0	3.7
5	.....	1.84	1.62	1.68	4.7	2.9	3.4
6	.....	1.8	1.62	3.6	4.2	2.8	3.4
7	.....	1.74	1.6	4.1	4.6	4.0	3.2
8	.....	1.7	1.61	2.95	4.1	4.8	3.1
9	.....	1.62	2.3	2.65	3.6	4.4	3.9
10	.....	1.65	1.92	2.65	3.2	4.3	5.4

[1] Measured by engineers of Ontario Power Co. from topographic maps.

Daily gage height, in feet, of Salmon River at Stillwater Bridge, near Redfield, N. Y., for 1911—Continued.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	.....	1.74	1.8	2.3	2.9	4.0	6.0
12	.....	1.86	1.78	2.45	2.7	3.8	7.7
13	.....	1.82	1.7	2.6	2.5	5.6	9.0
14	.....	1.69	1.68	2.35	2.4	4.9	6.6
15	.....	1.65	1.62	2.2	2.3	4.4	5.2
16	.....	1.65	1.78	2.5	2.25	4.0	4.9
17	.....	2.6	1.71	2.35	2.16	3.8	5.7
18	.....	3.8	1.65	2.2	3.6	4.4	5.0
19	.....	2.6	1.76	1.92	4.5	5.1	4.2
20	.....	2.15	1.79	1.85	3.9	4.7	3.8
21	.....	2.0	1.7	1.82	3.5	4.4	3.9
22	.....	1.86	1.6	2.2	3.2	4.0	3.6
23	.....	1.76	1.58	2.4	4.1	4.0	5.2
24	1.92	1.95	1.59	2.2	4.0	3.8	4.9
25	1.85	2.1	1.59	1.99	3.6	3.6	4.2
26	1.82	1.88	1.68	1.92	3.2	3.5	3.9
27	3.8	1.79	1.65	1.89	3.0	3.9	4.4
28	6.0	1.74	1.91	2.25	3.1	3.4	4.3
29	4.2	1.69	2.8	2.25	2.9	5.0	4.1
30	2.85	1.66	2.3	2.35	2.75	4.8	3.9
31	.....	1.64	2.0	.....	2.8	.....	3.5

Daily discharge, in second-feet, of Salmon River at Stillwater Bridge, near Redfield, N. Y., for 1911.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	262	79	155	200	770	960
2	.....	200	75	139	352	605	770
3	.....	155	71	133	312	470	685
4	.....	135	75	107	570	410	645
5	.....	123	79	91	1,120	380	535
6	.....	115	79	605	860	352	535
7	.....	103	75	815	1,070	770	470
8	.....	95	77	395	815	1,180	440
9	.....	79	225	312	605	960	725
10	.....	85	139	312	470	910	1,580
11	.....	103	115	225	380	770	2,080
12	.....	127	111	262	325	685	3,870
13	.....	119	95	300	275	1,740	5,550
14	.....	93	91	238	250	1,240	2,650
15	.....	85	79	200	225	960	1,440
16	.....	85	111	275	212	770	1,240
17	.....	300	97	238	191	685	1,820
18	.....	685	85	200	605	960	1,310
19	.....	300	107	139	1,020	1,380	860
20	.....	188	113	125	725	1,120	685
21	.....	155	95	119	570	960	725
22	.....	127	75	200	470	770	605
23	.....	107	71	250	815	770	1,440
24	139	145	73	200	770	685	1,240
25	125	177	73	153	605	605	860
26	119	131	91	139	470	570	725
27	685	113	85	133	410	725	960
28	2,080	103	137	212	440	535	910
29	860	93	352	212	380	1,310	815
30	366	87	225	238	338	1,180	725
31	.....	83	155	.....	352	.....	570

NOTE.—Daily discharge determined from a well-defined discharge rating curve.

Monthly discharge of Salmon River at Stillwater Bridge, near Redfield, N. Y., for 1911.

[Drainage area, 191 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
June 24-30	2,080	119	625	3.27	0.85	A.
July	685	79	153	.801	.92	A.
August	352	71	110	.576	.66	A.
September	815	91	237	1.24	1.38	A.
October	1,120	191	523	2.74	3.16	A.
November	1,740	352	841	4.40	4.91	A.
December	5,550	440	1,240	6.49	7.48	A.

SALMON RIVER AT PULASKI, N. Y.

Location.—At a highway bridge known locally as Fox's bridge, about 2½ miles above the village of Pulaski, 2¼ miles above Trout Brook (coming in from the left) and 6½ miles above the mouth of the river.

Records available.—Sept. 5, 1900, to June 30, 1907; Aug. 16, 1908, to Dec. 6, 1908; July 14, 1910, to Dec. 31, 1911. Published in reports of the New York State engineer and surveyor, New York State Water Supply Commission, and Conservation Commission of the State of New York.

Drainage area.—264 square miles.

Gage.—A vertical staff attached to the upstream end of the center pier of the bridge was read from Sept. 5, 1900, to the winter of 1901-2, when it was destroyed by ice. On July 23, 1902, a chain gage was installed the zero of which is 1.20 feet below the original staff gage zero. Datum of chain gage unchanged since established.

Channel.—Gravel; fairly permanent.

Discharge measurements.—Made either by wading or from the bridge.

Winter flow.—Relation of gage height to discharge affected by ice.

Accuracy.—Open-water curve well developed. Published data considered good.

Cooperation.—Maintained in cooperation with the State engineer and surveyor of New York prior to 1910, in cooperation with the State Water Supply Commission of New York beginning July 14, 1910.

Discharge measurements of Salmon River at Pulaski, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 11	C. S. De Golyer	5.56	3,450
21	C. C. Covert	5.99	4,690
May 15	C. S. De Golyer	3.11	416
22	do	3.00	343
June 23[a]	do	2.78	226
Sept. 17[a]	G. H. Canfield	2.88	274
17[a]	do	2.91	285
Nov. 21	C. S. De Golyer	4.00	1,170
Dec. 12	do	5.87	4,190
14	do	5.77	4,040

[a] Measurement made by wading at bridge.

Daily gage height, in feet, of Salmon River at Pulaski, N. Y., for 1911.

[Seymour Fox, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.60	3.06	3.15	2.45	2.70	2.84	3.65	4.05
2	.....	6.30	3.29	2.95	2.45	2.65	2.94	3.49	3.85
3	4.05	5.20	3.02	2.80	2.40	2.60	3.04	3.26	3.55
4	3.79	4.35	2.86	2.72	2.45	2.60	3.19	3.16	3.32
5	4.05	4.05	3.65	2.62	2.40	2.50	4.10	3.12	3.40
6	4.85	3.85	4.70	2.60	2.40	4.20	3.85	3.04	3.40
7	6.20	3.85	3.90	2.60	2.40	4.05	4.10	3.90	3.30
8	6.20	3.75	3.75	2.55	2.48	3.40	3.95	4.40	3.30
9	5.80	3.70	3.24	2.50	.....	3.22	3.44	3.95	3.60
10	5.60	3.60	3.09	2.50	2.75	3.18	3.29	3.60	4.70
11	5.50	3.46	2.94	2.50	2.60	2.95	3.14	3.65	5.00
12	5.70	3.36	3.65	2.65	2.58	2.90	3.04	3.52	6.00
13	5.90	3.24	3.85	2.60	2.50	2.90	2.96	4.90	7.00
14	6.50	3.14	3.50	2.52	2.45	2.85	2.86	4.35	5.70
15	7.10	3.09	3.19	2.48	2.45	2.80	2.82	4.05	4.65
16	6.30	3.04	3.06	2.50	2.50	2.95	2.74	3.80	4.45
17	5.40	3.02	2.96	3.05	2.48	2.90	2.76	3.34	4.95
18	5.20	2.96	2.84	4.00	2.45	2.79	3.32	4.05	4.50
19	5.30	2.96	2.79	3.32	2.52	2.66	4.05	4.40	4.05
20	5.60	3.19	2.74	2.90	2.45	2.62	3.65	4.15	3.50
21	5.80	3.09	2.64	2.80	2.42	2.59	3.42	4.00	3.48
22	5.30	2.96	2.69	2.70	2.40	2.79	3.39	3.75	3.60
23	4.95	2.92	2.74	2.60	2.40	2.94	3.60	3.55	4.35
24	4.75	3.16	2.68	2.62	2.40	2.82	3.75	3.55	4.45
25	5.50	3.22	2.65	2.78	2.40	2.72	3.44	3.50	4.05
26	5.60	3.09	2.65	2.68	2.42	2.64	3.29	3.50	3.80
27	5.50	2.92	3.95	2.62	2.42	2.64	3.14	3.45	3.90
28	5.40	2.84	5.40	2.55	2.58	2.76	3.14	3.48	4.00
29	5.50	2.79	4.00	2.55	3.10	2.86	3.14	4.55	3.48
30	5.40	2.72	3.65	2.50	2.95	2.84	3.04	4.35	3.40
31	.....	2.69	.....	2.50	2.78	.....	3.09	.....	3.42

NOTE.—Probably ice at this station from Jan. 1 to about Apr. 2.

Daily discharge, in second-feet, of Salmon River at Pulaski, N. Y., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,800	3,710	376	432	103	191	255	820	1,230
2	1,500	5,050	528	312	103	172	307	682	1,010
3	1,230	2,970	352	235	88	152	364	507	732
4	950	1,610	265	200	103	152	458	439	550
5	1,230	1,230	820	160	88	118	1,290	413	610
6	2,370	1,010	2,130	152	88	1,410	1,010	364	610
7	4,850	1,010	1,060	152	88	1,230	1,290	1,060	535
8	4,850	912	912	135	112	610	1,120	1,680	535
9	4,090	865	493	118	162	479	642	1,120	775
10	3,710	775	394	118	213	452	528	775	2,130
11	3,520	658	307	118	152	312	426	820	2,620
12	3,900	580	820	172	145	285	364	707	4,470
13	4,280	493	1,010	152	118	285	318	2,450	6,450
14	5,450	426	690	125	103	260	265	1,610	3,900
15	6,660	394	458	112	103	235	245	1,230	2,060
16	5,050	364	376	118	118	312	209	960	1,760
17	3,330	352	318	370	112	285	217	565	2,540
18	2,970	318	255	1,170	103	231	550	1,230	1,830
19	3,150	318	231	550	125	175	1,230	1,680	1,230
20	3,710	458	209	285	103	160	820	1,350	690
21	4,090	394	168	235	94	149	626	1,170	674
22	3,150	318	187	191	88	231	602	912	775
23	2,540	296	209	152	88	307	775	732	1,610
24	2,210	439	183	160	88	245	912	732	1,760
25	3,520	479	172	226	88	200	642	690	1,230
26	3,710	394	172	183	94	168	528	690	960
27	3,520	296	1,120	160	94	168	426	650	1,060
28	3,330	255	3,330	135	145	217	426	674	1,170
29	3,520	231	1,170	135	400	265	426	1,960	674
30	3,330	200	820	118	312	255	364	1,610	610
31	.....	187	.....	118	226	.....	394	.....	626

NOTE.—Daily discharge is based on a well-defined discharge rating curve. Discharge Apr. 1 to 2 estimated.

Monthly discharge of Salmon River at Pulaski, N. Y., for 1911.

[Drainage area, 264 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
April	6,660	950	3,380	12.8	14.28	A.
May	5,050	187	871	3.30	3.80	A.
June	3,330	168	651	2.47	2.76	A.
July	1,170	112	226	.856	.99	A.
August	400	88	131	.496	.57	A.
September	1,410	118	324	1.23	1.37	A.
October	1,290	209	582	2.20	2.54	B.
November	2,450	364	1,010	3.83	4.27	A.
December	6,450	535	1,530	5.80	6.69	A.

ORWELL BROOK NEAR ALTMAR, N. Y.

Location.—At highway bridge 1½ miles by road northwest of Altmar and ⅛ mile above confluence of Orwell Brook with Salmon River.

Records available.—June 23 to December 31, 1911.

Drainage area.—22.1 square miles.

Gage.—Standard chain, attached to downstream side of bridge.

Channel.—Curved above the bridge and current rather swift. Bed composed of small stone and gravel; 2 channels above bridge, but one at gage.

Discharge measurements.—Made by wading at low stages, from bridge at high stages.

Winter flow.—No information; relation of gage height to discharge probably affected by ice.

Accuracy.—The discharge rating curve has been fairly well developed for low stages.

Cooperation.—Established by United States Geological Survey in cooperation with David R. Cooper, of Niagara Falls, N. Y., and State of New York Conservation Commission.

Discharge measurements of Orwell Brook near Altmar, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 22	C. S. De Golyer	[b] 1.98	19.9
June 23[a]	do	1.92	13.8
Sept. 14[a]	G. H. Canfield	2.00	17.6
14[a]	do	2.01	18.2
17[a]	do	1.97	15.2
Nov. 14[c]	C. S. De Golyer	2.83	98.6
Dec. 12	do	3.64	227

[a] Measurement made by wading a short distance below bridge.
[b] Measurement made before gage was established; gage height uncertain.
[c] Made by wading 200 feet below bridge.

Daily gage height, in feet, of Orwell Brook near Altmar, N. Y., for 1911.

[Mrs. A. G. White, observer.]

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.22	1.70	1.85	1.98	2.28	2.78
2	.....	2.12	1.70	1.80	2.08	2.22	2.49
3	.....	2.08	1.70	1.78	2.00	2.20	2.48
4	.....	2.00	1.70	1.72	2.30	2.15	2.42
5	.....	1.95	1.70	1.65	2.30	2.10	2.45
6	.....	1.90	1.65	2.80	2.28	2.05	2.34
7	.....	1.88	1.65	2.32	2.55	2.45	2.28
8	.....	1.85	1.88	2.15	2.35	2.48	2.26
9	.....	1.85	2.02	2.18	2.22	2.38	2.90
10	.....	1.80	1.85	2.05	2.12	2.35	3.10
11	.....	1.80	1.80	1.98	2.08	2.30	3.40
12	.....	1.82	1.75	2.00	2.02	2.48	3.65
13	.....	1.80	1.70	1.98	2.02	2.98	4.20
14	.....	1.75	1.65	1.92	2.00	2.86	3.20
15	.....	1.80	1.68	1.95	1.95	2.60	2.88
16	.....	1.75	1.75	1.92	1.95	2.49	2.80
17	.....	2.45	1.75	1.92	1.95	3.55	2.98
18	.....	2.62	1.75	1.95	2.40	2.88	2.75
19	.....	2.28	1.80	1.90	2.38	2.82	2.52
20	.....	2.08	1.75	1.92	2.22	2.72	2.60
21	.....	1.95	1.70	1.85	2.18	2.61	2.52
22	.....	1.90	1.65	2.12	2.10	2.50	2.35
23	1.95	1.82	1.65	2.02	2.32	2.50	2.85
24	1.78	1.98	1.65	1.95	2.28	2.45	2.62
25	1.75	1.82	1.70	1.90	2.20	2.38	2.50
26	1.75	1.82	1.75	1.90	2.12	2.40	2.45
27	3.50	1.80	1.70	1.88	2.15	2.40	2.62
28	4.60	1.78	1.85	2.02	2.18	2.48	2.28
29	2.90	1.75	2.02	1.98	2.10	3.20	2.48
30	2.40	1.75	1.82	2.00	2.05	2.80	2.52
31	.....	1.75	1.75	.....	2.15	.....	2.45

Daily discharge, in second-feet, of Orwell Brook near Altmar, N. Y., for 1911.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	32	6	11	16	36	92
2	.....	24	6	9	22	32	57
3	.....	22	6	8	17	30	56
4	.....	17	6	7	38	26	50
5	.....	15	6	5	38	23	53
6	.....	13	5	95	36	20	42
7	.....	12	5	40	64	53	36
8	.....	11	12	26	43	56	35
9	.....	11	18	28	32	46	109
10	.....	9	11	20	24	43	139
11	.....	9	9	16	22	38	186
12	.....	10	8	17	18	56	229
13	.....	9	6	16	18	121	330
14	.....	8	5	14	17	103	154
15	.....	9	6	15	15	70	106
16	.....	8	8	14	15	57	95
17	.....	53	8	14	15	212	121
18	.....	72	8	15	48	106	88
19	.....	36	9	13	46	98	60
20	.....	22	8	14	32	85	70
21	.....	15	6	11	29	71	60
22	.....	13	5	24	23	58	43
23	15	10	5	18	40	58	102
24	8	16	5	15	36	53	72
25	8	10	6	13	30	46	58
26	8	10	8	13	24	48	53
27	203	9	6	12	26	48	72
28	410	8	11	18	29	56	36
29	109	8	18	16	23	154	56
30	48	8	10	17	20	95	60
31	.....	8	8	.....	26	.....	53

NOTE.—Daily discharge determined from a discharge rating curve well defined between 10 and 300 second-feet.

Monthly discharge of Orwell Brook near Altmar, N. Y., for 1911.

[Drainage area, 22.1 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
June 23-30	410	8	101.	4.57	1.36	B.
July	72	8	16.7	.756	.87	B.
August	18	5	7.87	.356	.41	C.
September	95	5	18.5	.837	.93	B.
October	64	15	28.5	1.29	1.49	A.
November	154	20	66.6	3.01	3.36	A.
December	330	35	89.5	4.05	4.67	A.

BLACK RIVER AND TRIBUTARIES.

BLACK RIVER NEAR BOONVILLE, N. Y.

Location.—At highway bridge about 2 or 3 miles northeast of Boonville, an equal distance by river downstream from Hawkinsville, and about 1 mile above the mouth of Sugar River, a small tributary from the left.

Records available.—February 16 to December 31, 1911; data also published in first annual report of Conservation Commission, State of New York.

Drainage area.—316 square miles.

Gage.—Standard chain, fastened to the downstream side of the bridge. A staff gage, reading from 6 to 13 feet, is fastened to the downstream right-hand abutment and is used for high-water readings.

Channel.—Rough and bowldery; permanent.

Discharge measurements.—At high stages from a cable stretched across the stream about one-half mile above the gage; at low stages, by wading near the cable section.

Winter flow.—Relation of gage height to discharge affected by ice.

Accuracy.—A well-defined discharge rating curve has been developed. The records do not give the total discharge of the drainage area. See "Diversions."

Diversions.—A portion of the flow of Black River is diverted past the gaging station through a feeder having its intake at the State dam at Forestport and delivering its flow to the summit level of the Black River canal at Boonville. A portion of the flow passes northward, supplying the Black River canal from Boonville to the head of slack-water navigation at the foot of Lyon Falls. The remainder is diverted from the drainage basin and flows into the Erie Canal at Rome. To determine the amount diverted past the station and out of the drainage basin measurements are made in the Forestport feeder at a farm bridge near Speny Hill, 1 mile northeast of Boonville. Measurements of northward flow in the Black River canal are made at a farm bridge half a mile north of Boonville; measurements of the southward flow at a farm bridge about three-fourths of a mile southeast from Boonville. The Forestport feeder is open for service about May 1 for the purpose of feeding the Erie Canal, which opens about May 15, although the Black River canal does not open until later. When navigation is closed on the Erie Canal the feeder gates are closed also and the surplus water runs over the dam into Black River. Some water leaks through feeder gates and flows through the feeder into Lansing Kill and Mohawk River. Feeder gates were closed November 20, 1911. Results of measurements made at this place in the past are published in reports of the State engineer and surveyor of New York.

Storage.—A reservoir built by the State at Forest Brook, about 8 miles upstream, stores about 2,000,000,000 cubic feet. About a mile above the station is a site at which a dam 110 feet high would impound 3,300,000,000 cubic feet of water.

Cooperation.—Established and maintained in cooperation with the State Conservation Commission of New York.

Discharge measurements of Black River near Boonville, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 16[a]	Hoyt and Shuttleworth	4.99	307
Apr. 22[b]	C. C. Covert	7.60	2,410
June 30[c]	C. S. De Golyer	3.75	107
Aug 20[c]	C. C. Covert	3.40	59.1
Sept. 13[d]	G. H. Canfield	4.55	268
13[c]	do	4.50	244
Nov. 23	C. S. De Golyer	5.97	949
23	do	6.00	924
Dec. 13	do	8.43	3,850

[a] Measurement made under complete ice cover about one-half mile above bridge and gage; average thickness of ice, 1.56 feet.
[b] Measurement made from bridge on which gage is fastened; poor section in high water.
[c] Measurement made by wading about 200 feet above bridge.
[d] Wading at cable section.

Discharge measurements of Forestport feeder at Boonville, N. Y., in 1911.

Date.	Hydrographer.	Gage height.[a]	Discharge.
		Feet.	*Sec.-ft.*
June 30	C. S. De Golyer	1.35	[b] 296
Aug. 20	C. C. Covert	1.13	[b] 236
Sept. 13	G. H. Canfield	1.19	[b] 253
Nov. 23	C. S. De Golyer	3.53	[b] 80

[a] Distance reference point to water surface. Reference point is top of mudsill at left, upstream side of bridge.
[b] Amount of water from Black River into Forestport feeder.

NOTE.—Measurements made at highway bridge about 1 mile northeast of Boonville, N. Y.

Discharge measurements of Black River canal (north) at Boonville, N. Y., in 1911.

Date.	Hydrographer.	Gage height.[a]	Discharge.
		Feet.	*Sec.-ft.*
July 1	G. E. Carman	1.82	[b] 69.4
Sept. 14	G. H. Canfield	1.42	[b] 63.0

[a] Distance reference point to water surface. Reference point is top of mudsill at right upstream side of bridge.
[b] Amount of water diverted permanently to Erie Canal.

NOTE.—Measurements made at second bridge south of feeder, about three-fourths mile south of Boonville, N. Y.

Discharge measurements of Black River canal (south) at Boonville, N. Y., in 1911.

Date.	Hydrographer.	Gage height.[a]	Discharge.
		Feet.	*Sec.-ft.*
June 30	C. S. De Golyer	1.36	6,232
Aug. 19	C. C. Covert	1.35	6,162
Sept. 13	G. H. Canfield	1.21	6,159

[a] Distance reference point to water surface. Reference point is top of mudsill at left upstream side of bridge.

[b] Amount of water returning to Black River below gaging station.

NOTE.—Measurements made at bridge No. 2, about one-half mile north of Boonville, N. Y.

Daily gage height, in feet, of Black River near Boonville, N. Y., for 1911.

[W. D. Charboneau, observer.]

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.2	6.5	8.2	5.4	3.4	3.22	3.58	3.48	5.0	6.5
2	.....	5.1	6.0	8.8	6.1	3.36	3.19	3.52	3.5	5.1	5.9
3	.....	5.1	5.85	9.0	5.2	3.36	3.19	3.76	3.45	4.95	5.8
4	.....	5.2	5.69	7.8	4.7	3.5	3.21	4.6	3.75	4.7	5.5
5	.....	5.05	5.8	7.2	5.05	3.38	3.22	4.6	4.8	4.38	5.4
6	.....	5.0	6.4	7.0	6.6	3.22	3.5	4.65	4.95	4.35	5.4
7	.....	4.55	7.6	6.6	6.2	3.31	3.78	5.2	5.9	4.9	5.3
8	.....	4.08	7.6	6.4	5.45	3.25	3.84	4.9	5.85	5.9	5.25
9	.....	4.55	7.6	6.1	5.1	3.24	3.82	4.9	5.4	6.1	5.4
10	.....	4.55	7.3	5.85	4.8	3.26	3.55	5.0	4.65	5.6	5.9
11	.....	5.15	7.1	5.65	4.6	3.28	3.31	5.0	3.95	5.4	6.3
12	.....	5.05	7.2	5.45	6.0	3.24	3.36	4.48	3.88	5.7	6.9
13	.....	5.0	7.4	5.4	7.0	3.28	3.32	4.5	3.82	6.0	8.5
14	.....	4.95	7.9	5.0	7.0	3.29	3.32	4.2	3.77	6.1	8.3
15	.....	5.0	8.8	4.8	6.4	3.31	3.3	3.68	3.68	5.7	7.3
16	4.99	4.65	8.9	4.8	5.9	3.71	3.38	3.45	3.58	5.5	6.8
17	5.0	5.05	8.0	4.7	5.8	4.1	3.45	3.85	3.5	5.15	7.0
18	5.3	5.0	7.2	4.6	5.45	4.38	3.35	3.68	3.98	5.8	7.0
19	5.45	4.8	7.2	4.9	5.0	3.78	3.38	3.7	5.3	6.7	6.6
20	5.3	4.9	7.2	5.0	4.6	3.35	3.35	3.42	5.3	6.8	5.9
21	5.2	4.9	7.3	5.0	4.38	3.31	3.36	3.35	4.95	6.5	5.7
22	5.15	5.05	7.5	4.8	4.2	3.27	3.26	3.48	5.0	6.1	5.8
23	5.05	5.25	7.3	4.85	4.18	3.32	3.34	3.58	5.7	5.75	6.1
24	5.0	5.3	6.9	5.2	3.88	3.48	3.25	3.52	5.5	5.9	7.6
25	5.0	5.25	7.5	5.9	3.72	3.45	3.19	3.58	5.6	5.75	6.6
26	5.0	5.1	7.9	5.75	3.62	3.35	3.12	3.42	5.25	5.6	6.4
27	5.3	6.4	7.6	5.45	3.68	3.3	3.18	3.32	5.05	5.6	6.3
28	5.2	8.3	7.6	5.5	3.93	3.32	3.65	3.38	5.15	5.5	6.4
29	.....	7.4	8.0	4.75	3.75	3.24	5.2	3.32	5.15	6.4	6.2
30	.....	7.3	8.2	4.55	3.7	3.24	4.1	3.38	4.9	6.8	5.95
31	.....	6.9	.....	4.35	.....	3.22	3.8	.....	4.7	.....	5.9

NOTE.—Relation of gage height to discharge affected by backwater from ice from about Jan. 1 to about Mar. 27. Probably no backwater from ice during December. Gage heights were probably taken to the water surface. Canal feeder closed Nov. 20.

Daily discharge, in second-feet, of Black River near Boonville, N. Y., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1,320	3,480	590	61	44	82	70	410	1,320
2	.....	950	4,560	1,020	57	41	74	72	450	880
3	.....	848	4,960	495	57	41	106	66	390	815
4	.....	749	2,850	305	72	43	275	104	305	640
5	.....	815	2,040	430	59	44	275	335	224	590
6	.....	1,240	1,810	1,410	44	72	290	390	218	590
7	.....	2,560	1,410	1,090	52	109	495	880	370	540
8	.....	2,560	1,240	615	46	119	370	848	880	518
9	.....	2,560	1,020	450	46	115	370	590	1,020	590
10	.....	2,160	848	335	47	78	410	390	695	880
11	.....	1,920	725	275	49	52	410	138	590	1,160
12	.....	2,040	615	950	46	57	246	126	755	1,700
13	.....	2,290	590	1,810	49	53	250	115	950	4,000
14	.....	3,000	410	1,810	50	53	186	108	1,020	3,650
15	.....	4,560	335	1,240	52	51	94	94	755	2,160
16	.....	4,760	335	880	98	59	66	82	640	1,600
17	.....	3,160	305	815	166	66	120	72	472	1,810
18	.....	2,040	275	615	224	56	94	143	815	1,810
19	.....	2,040	370	410	109	59	97	540	1,500	1,410
20	.....	2,040	410	275	56	56	63	540	1,600	880
21	.....	2,160	410	224	52	57	56	390	1,320	755
22	.....	2,420	335	186	48	47	70	410	1,020	815
23	.....	2,160	352	182	53	55	82	755	785	1,020
24	.....	1,700	495	126	70	46	74	640	880	2,560
25	.....	2,420	880	100	66	41	82	695	785	1,410
26	.....	3,000	785	87	56	36	63	518	695	1,240
27	1,240	2,560	615	94	51	40	53	430	695	1,160
28	3,650	2,560	640	134	53	90	59	472	640	1,240
29	2,290	3,160	320	104	46	495	53	472	1,240	1,090
30	2,160	3,480	262	97	46	166	59	370	1,600	915
31	1,700	.....	218	.....	44	112	.....	305	.....	880

NOTE.—Daily discharge determined from a well-defined discharge rating curve.

Monthly discharge of Black River near Boonville, N. Y., for 1911.

[Drainage area, 316 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	375	1.19	1.37	C.
February	.....	.....	275	.870	.91	C.
March	3,650	.....	608	1.92	2.21	B.
April	4,760	749	2,310	7.31	8.16	A.
May	4,960	218	1,090	3.45	3.98	A.
June	1,810	87	572	1.81	2.02	A.
July	224	44	65.3	.207	.24	A.
August	495	36	79.1	.250	.29	A.
September	495	53	167	.528	.59	A.
October	880	66	360	1.14	1.31	A.
November	1,600	218	791	2.50	2.79	A.
December	4,000	518	1,310	4.15	4.78	A.
The year	4,960	36	667	2.11	28.65	

NOTE.—Discharge Jan. 1 to Mar. 26 estimated from that of Black River at Felts Mills, the rate of run-off at Boonville being considered slightly less than at Felts Mills during this period.

Mean discharge Mar. 1 to 26, estimated, 300 second-feet.

BLACK RIVER NEAR FELTS MILLS, N. Y.

Location.—At the dam of the Lefevre Paper Co., formerly owned by the Black River Traction Co., about 1½ miles above the village of Felts Mills. The dam is 9 miles upstream from Watertown and 7 miles upstream from the old Huntingtonville gaging station.

Records available.—February, 1897 to December, 1901, at Huntingtonville dam, August 29, 1902, to December 31, 1911, at Felts Mills. Data also in annual reports of the State engineer and surveyor, State of New York.

Drainage area.—1,851 square miles.

Gage.—Vertical staff attached to a crib at the left-hand side of the stream above the mill; correction is made to gage readings for velocity of approach during the high water.

Discharge.—Previous to August 16, 1910, records were kept of the flow over a dam about 100 feet upstream from the paper mill. This dam was of sawed timber resting on a limestone foundation and its main crest was 380.6 feet long. During the summer of 1910 a new concrete dam was constructed about 100 feet downstream. This dam has a main crest for low and medium stages 300.45 feet long and 3.75 feet wide. Upstream face vertical; downstream semiogee section. Main crest of dam about 6 feet high. On the right-hand side is an additional section, of greater elevation, 48.2 feet long; on the left-hand side, angling upstream, is a section 139.7 feet long, making the total length of the dam for high-water discharge approximately 488.4 feet. A wood-pulp mill constructed at the left-hand end of the dam has been in operation since 1907. The mill contains one 45-inch and four 72-inch Smith-McCormick turbines. The discharge over the spillways has been calculated by means of the weir formula, using coefficients derived from experiments by the United States Geological Survey on a dam of similar cross-section. Record is kept of the hours run and of the gate opening of each wheel as well as the head under which the turbines operate.

Winter flow.—Affected by ice. No correction attempted.

Artificial control.—Power plants and storage above the station.

Accuracy.—Results believed to be good for a station of this type.

Cooperation.—Records obtained and computations made by engineers of the New York State engineer's department, which furnishes the data to the Survey.

Daily discharge, in second-feet, of Black River near Felts Mills, N. Y., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,929	2,842	2,151	6,808	12,766	1,655	873	793	1,600	1,435	2,186	6,232
2	2,158	2,693	2,019	6,472	14,676	2,693	873	793	1,290	816	2,447	6,099
3	3,941	2,282	1,888	5,654	17,181	3,287	873	634	240	1,190	2,447	5,079
4	5,208	2,151	1,888	4,747	19,123	2,414	714	793	801	1,948	2,314	3,318
5	4,990	1,888	1,655	4,530	15,799	2,019	634	714	1,215	2,728	2,011	3,772
6	4,344	1,888	1,536	7,319	12,241	5,340	475	714	1,290	3,066	1,550	3,531
7	3,468	1,830	1,597	12,241	9,633	5,497	714	634	2,657	3,066	2,186	3,611
8	4,125	1,772	1,655	14,258	7,575	5,183	714	634	2,381	3,061	4,180	3,531
9	2,839	1,713	1,536	16,351	6,136	3,771	873	714	2,624	3,386	4,991	3,611
10	2,606	1,655	1,536	17,181	5,654	3,139	793	793	1,849	2,728	4,991	7,995
11	2,606	1,536	1,536	14,957	4,965	2,414	634	873	1,550	2,314	4,518	8,011
12	2,364	1,536	1,536	13,302	4,094	2,019	634	952	1,908	2,186	4,515	8,668
13	2,839	1,536	1,536	13,029	3,448	3,448	634	873	2,186	1,908	3,864	10,554
14	2,578	1,536	1,830	13,575	2,151	4,530	634	1,038	2,006	1,799	4,991	13,547
15	2,414	1,597	3,139	16,075	2,282	5,183	714	1,038	1,853	1,568	4,991	16,335
16	2,414	1,888	2,842	18,013	2,282	5,183	793	1,529	1,511	1,292	4,518	13,868
17	2,414	1,888	2,282	18,845	1,772	5,183	873	1,668	1,502	1,237	3,779	11,624
18	2,282	1,536	2,019	16,075	2,151	4,094	1,123	1,719	665	1,361	3,066	10,258
19	1,888	1,536	1,888	13,849	2,151	3,448	1,655	1,771	1,190	1,618	5,876	9,024
20	1,597	1,655	1,772	11,715	2,282	2,842	1,207	1,043	910	1,600	5,313	7,802

Daily discharge, in second-feet, of Black River near Felts Mills, N. Y., for 1911—Contd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	1,655	1,713	1,655	10,959	2,545	2,282	1,040	1,005	839	2,024	6,499	3,919
22	1,655	1,713	1,655	10,456	2,842	1,888	873	887	839	2,163	6,499	3,741
23	1,655	2,019	2,151	9,633	2,545	1,655	957	1,062	1,039	1,550	4,788	5,804
24	1,655	1,888	2,545	9,442	3,610	1,536	957	1,290	1,502	1,696	4,140	8,913
25	1,772	1,772	2,414	9,252	4,530	1,291	555	1,202	600	3,552	4,140	8,136
26	1,655	1,655	2,545	9,019	4,747	1,123	793	1,238	839	3,028	3,244	7,267
27	1,207	1,536	3,771	9,442	4,312	1,040	714	677	939	2,447	2,732	6,845
28	2,151	2,085	9,442	10,456	3,287	1,772	793	1,052	1,034	2,186	3,779	5,804
29	3,139	.....	8,319	11,463	2,693	1,655	873	1,261	839	1,849	6,499	3,868
30	2,990	.....	7,830	12,241	2,693	1,413	957	1,799	1,053	1,183	6,499	3,552
31	3,287	.....	7,319	.....	2,151	.....	793	1,908	.....	2,024	.....	4,193

Monthly discharge of Black River near Felts Mills, N. Y., for 1911.

[Drainage area, 1,851 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
January	5,208	1,207	2,672	1.44	1.66
February	2,842	1,536	1,834	0.991	1.03
March	9,442	1,536	2,822	1.52	1.75
April	18,845	4,530	11,579	6.26	6.98
May	19,123	1,772	5,946	3.21	3.70
June	5,497	1,040	2,967	1.60	1.78
July	1,655	475	830	0.448	0.516
August	1,908	634	1,068	0.577	0.665
September	2,657	240	1,338	0.723	0.807
October	3,552	816	2,065	1.12	1.29
November	6,499	1,550	4,118	2.22	2.48
December	16,335	3,318	7,049	3.81	4.39
Year	19,123	240	3,690	1.99	27.098

MOOSE RIVER AT MOOSE RIVER, N. Y.

Location.—In the village of Moose River, about 3 miles downstream from McKeever station on the Adirondack division of the New York Central & Hudson River Railroad, 5 miles below the mouth of South Branch of Moose River (coming in from the left), and nearly 20 miles above the junction of Black and Moose rivers at Lyons Falls.

Records available.—June 5, 1900, to December 31, 1911. Data also in annual reports of the New York State engineer and surveyor and State Water Supply Commission of New York.

Drainage area.—346 square miles.

Gage.—Staff, in two sections, fastened to the left bank a short distance above cable; read twice daily. The elevation of the gage zero was changed February 28, 1903, from 15.36 to 15.53.

Channel.—Composed of cobble and bowlders; fairly permanent; current smooth; depth comparatively uniform. Just above the station is a small island on which ice and log jams occasionally form. Velocity from dam at McKeever to the station relatively slow; below the station velocity very high.

Discharge measurements.—Made from a cable erected July, 1903. Cable has a clear span of 269 feet.

Artificial control.—A timber dam at McKeever is used for power and for the regulation of flow for log driving. During portions of the year, therefore, two gage readings a day may not give a representative mean.

Winter flow.—The stream freezes over in winter and is covered with alternate layers of ice and snow which render the determination of discharge difficult.

Accuracy.—Discharge rating curve for open channel fairly accurate. Published discharge data for periods of open water considered good.

Cooperation.—The station was established and is maintained in cooperation with the New York State engineer and surveyor.

Discharge measurements of Moose River at Moose River, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 29[a]	W. G. Hoyt	6.54	4,700
July 15	C. S. De Golyer	1.04	307

[a] Measurement partly estimated by timing floating logs to obtain velocity. Area determined by separate soundings. Coefficient of 0.84, from vertical velocity curves taken in 1904, used to reduce surface velocities.

Daily gage height, in feet, of Moose River at Moose River, N. Y., for 1911.

[Chris Hannan, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.6			4.0	6.6	2.0	1.6	0.8	0.5	1.0	3.0	2.2
2	2.2				8.6	2.2	1.5	.8	.5	1.1	2.9	2.1
3	2.9				6.6	2.3	1.5	.75	.6	1.2	3.0	2.2
4	3.2	2.9	2.4		5.2	2.2	1.35	.7	.6	1.15	3.1	2.3
5	3.4				5.2	2.5	1.2	.6	.75	1.5	3.0	2.4
6	3.5				5.0	2.9	1.05	.5	.9	1.9	3.2	2.5
7	3.9				4.7	2.8	.9	.6	.9	2.0	3.6	2.6
8	4.2			4.5	4.2	2.6	.85	.6	.8	2.0	3.95	2.7
9	4.2				4.1	2.2	.7	.5	.8	2.1	3.9	3.1
10	2.2				4.0	2.0	1.05	.5	.8	2.2	3.8	3.6
11	1.8	2.9	2.6		3.4	1.9	1.1	.6	.9	1.9	3.7	4.4
12					3.0	2.0	1.1	.6	.9	1.8	3.6	5.2
13					2.7	2.0	1.1	.75	.9	1.8	3.3	7.0
14	2.3				2.6	1.8	1.1	.7	.8	1.9	3.0	5.5
15				6.4	2.6	1.8	1.2	.65	.9	1.9	2.6	4.3
16				5.9	2.4	1.7	.95	.6	1.0	1.8	2.1	4.0
17				4.6	2.3	1.6	1.2	.7	.9	2.0	1.8	3.8
18		2.6	2.6	3.7	2.2	1.6	1.55	.6	.8	2.2	1.6	3.8
19				3.2	2.0	1.6	1.65	.6	.7	2.4	1.6	3.6
20				3.1	2.0	1.7	1.3	.7	.7	2.8	1.6	3.4
21	2.3			3.5	2.2	1.6	1.15	.7	.8	3.0	1.5	3.3
22				3.9	2.2	1.5	1.0	.6	.9	3.0	1.5	3.4
23				3.6	2.6	1.6	1.1	.6	.9	3.1	1.4	3.6
24				3.8	2.2	1.6	1.0	.5	.8	3.0	1.5	3.8
25		2.6	2.4	4.0	2.2	1.5	1.1	.5	.7	3.0	1.6	4.4
26				5.0	2.3	1.6	1.0	.5	.8	3.1	1.5	4.0
27				5.8	2.4	1.6	.9	.6	.9	3.0	1.6	3.4
28	2.5			6.0	2.3	1.5	.85	.6	1.0	3.0	1.7	3.5
29				6.6	2.3	1.6	.7	.7	1.0	3.1	2.0	3.8
30				6.3	2.1	1.6	.7	.8	.9	3.0	2.2	3.5
31					2.2		.7	.6		3.1		3.1

NOTE.—Relation of gage height to discharge affected by ice Jan. 1 to Apr. 14. Probably not much back water from ice during December. The gage readings were probably to water surface.

Daily discharge, in second-feet, of Moose River at Moose River, N. Y., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4,780	610	465	240	175	290	1,150	700
2	.....	7,200	700	435	240	175	315	1,080	650
3	.....	4,780	750	435	228	195	345	1,150	700
4	.....	3,140	700	390	215	195	330	1,220	750
5	.....	3,140	855	345	195	228	435	1,150	800
6	.....	2,920	1,080	312	175	265	570	1,290	855
7	.....	2,600	1,020	265	195	265	610	1,590	910
8	.....	2,120	910	252	195	240	610	1,900	965
9	.....	2,030	700	215	175	240	650	1,850	1,220
10	.....	1,940	610	302	175	240	700	1,760	1,590
11	.....	1,430	570	315	195	265	570	1,670	2,300
12	.....	1,150	610	315	195	265	535	1,590	3,140
13	.....	965	610	315	228	265	535	1,360	5,260
14	.....	910	535	315	215	240	570	1,150	3,470
15	4,540	910	535	345	205	265	570	910	2,210
16	3,940	800	500	278	195	290	535	650	1,940
17	2,500	750	465	345	215	265	610	535	1,760
18	1,670	700	465	450	195	240	700	465	1,760
19	1,290	610	465	482	195	215	800	465	1,590
20	1,220	610	500	375	215	215	1,020	465	1,430
21	1,510	700	465	330	215	240	1,150	435	1,360
22	1,850	700	435	290	195	265	1,150	435	1,430
23	1,590	910	465	315	195	265	1,220	405	1,590
24	1,760	700	465	290	175	240	1,150	435	1,760
25	1,940	700	435	315	175	215	1,150	465	2,300
26	2,920	750	465	290	175	240	1,220	435	1,940
27	3,820	800	465	265	195	265	1,150	465	1,430
28	4,060	750	435	252	195	290	1,150	500	1,510
29	4,780	750	465	215	215	290	1,220	610	1,760
30	4,420	650	465	215	240	265	1,150	700	1,510
31	.....	700	.....	215	195	.....	1,220	.....	1,220

NOTE.—Daily discharge determined from a discharge rating curve well defined between 240 and 3,650 second-feet.

Monthly discharge of Moose River at Moose River, N. Y., for 1911.

[Drainage area, 346 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	600	1.73	1.99	C.
February	.....	.....	400	1.16	1.21	C.
March	.....	.....	700	2.02	2.33	C.
April	.....	.....	2,630	7.60	8.48	B.
May	4,780	610	1,660	4.80	5.53	B.
June	1,080	435	592	1.71	1.91	B.
July	482	215	321	.928	1.07	B.
August	240	175	202	.584	.67	B.
September	290	175	244	.705	.79	B.
October	1,220	290	782	2.26	2.61	B.
November	1,900	405	943	2.73	3.05	B.
December	5,260	650	1,670	4.83	5.57	B.
The year	.....	175	897	2.59	35.21	

NOTE.—Discharge Jan. 1 to Apr. 14 estimated at approximately 25 per cent of the discharge of Black River at Felts Mills.

Mean discharge Apr. 1 to 14 estimated 2,500 second-feet.

MIDDLE BRANCH OF MOOSE RIVER AT OLD FORGE, N. Y.

Location.—About 300 feet below the highway bridge in Old Forge and about 400 feet below the dam.

Records available.—November 9, 1911, to December 31, 1911; published also in annual report of New York State Conservation Commission.

Drainage area.—51.5 square miles.

Gage.—Vertical staff, graded to feet and tenths, reading from 1 foot to 7 feet, spiked to birch tree on left bank of stream 300 feet below highway bridge.

Channel.—Fairly straight from dam to a point about 200 feet below the gage where the river turns abruptly to the right and flows over a rock reef which is the control point for the gage. Channel fairly uniform from dam to point of control. Right bank high and wooded; left bank from the highway bridge to within about 50 feet of the gage, defined by a stone wall about 3 feet above ordinary low water.

Accuracy.—Station rated from ordinary low water to ordinary high water, the rating table covering a gage ranging from 1.60 feet to 3 feet, inclusive. Conditions at the station considered good.

Discharge measurements of Middle Branch of Moose River at Old Forge, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Aug. 21 *a*	C. C. Covert	1.96	79.3
Nov. 8 *a*	C. S. De Golyer	1.73	53.4
8 *a*	do	2.16	112
8 *a*	do	2.44	150
6 *a*	do	2.90	241

a Measurements made by wading in front of State hatchery 150 feet above the gage.

Daily gage height, in feet, and discharge, in second-feet, of Middle Branch of Moose River at Old Forge, N. Y., for 1911.

[Vernon S. Ervin, observer.]

Day.	November.		December.		Day.	November.		December.	
	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.
1			2.55	172	16	2.70	201	3.00	262
2			2.55	172	17	2.70	201	3.00	262
3			2.50	163	18	2.65	192	3.00	262
4			2.50	163	19	2.65	192	3.00	262
5			2.50	163	20	2.65	192	3.00	262
6			2.45	154	21	2.65	192	2.95	252
7			2.45	154	22	2.60	182	2.90	241
8			2.45	154	23	2.60	182	2.90	241
9	2.30	128	2.45	154	24	2.60	182	2.95	252
10	2.35	136	2.45	154	25	2.60	182	2.95	252
11	2.35	136	2.45	154	26	2.60	182	2.95	252
12	2.35	136	2.42	149	27	2.55	172	2.90	241
13	2.40	145	2.60	182	28	2.55	172	2.85	231
14	2.70	201	2.80	221	29	2.50	163	2.80	221
15	2.79	219	2.95	252	30	2.55	172	2.80	221
					31			2.75	211

NOTE.—Daily discharge determined from a well-defined discharge rating curve.

Monthly discharge of Middle Branch of Moose River at Old Forge, N. Y., for 1911.

[Drainage area, 51.5 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
November (9-30)	219	128	175	3.40	2.78	A.
December	262	149	209	4.06	4.68	A.

STREAMS FLOWING TO ST. LAWRENCE RIVER.

OSWEGATCHIE RIVER NEAR OGDENSBURG, N. Y.

Location.—At the steel highway bridge known locally as Eel Weir bridge, about 1 mile below the mouth of the outlet of Black Lake and 5½ miles above the city of Ogdensburg and the mouth of the river.

Records available.—April 22, 1903, to December 31, 1911. Data published also in annual reports of the State Water-Supply Commission, State Conservation Commission, and State engineer and surveyor, State of New York.

Drainage area.—1,580 square miles.

Gage.—Chain, fastened to the upstream side of the bridge; read once daily; datum unchanged.

Channel.—Rocky and partly artificial, the rock having been removed underneath the bridge by blasting to increase the bridge opening.

Discharge measurements.—Usually made from the bridge.

Artificial control.—Three dams in the vicinity of the gage: One at Heuvelton, about 5 miles above; one at Rensselaer Falls, 10 miles above, and one at Ogdensburg.

Winter flow.—Not affected by ice, as velocity of the current at the station is swift.

Accuracy.—Rating curve fairly well developed; open-water curve used throughout the year.

Cooperation.—Established by the United States Geological Survey in cooperation with the State engineer and surveyor of New York.

Discharge measurements of Oswegatchie River near Ogdensburg, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 18	F. J. Shuttleworth	5.05	1,290
July 1[a]	G. H. Canfield	5.22	1,050

[a] Measurement made from upstream side of bridge where measuring conditions are poor.

Daily gage height, in feet, of Oswegatchie River near Ogdensburg, N. Y., for 1911.

[Joseph H. La Rue, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.2	5.7	5.2	8.6	6.3	6.1	5.1	4.5	4.4	4.7	4.9	6.5
2	5.2	5.7	5.2	8.3	6.4	6.0	5.1	4.5	4.4	4.6	4.9	6.5
3	5.3	5.7	5.4	8.1	6.3	5.8	5.1	4.5	4.4	4.6	5.0	6.5
4	5.9	5.7	5.5	8.0	6.4	5.7	5.1	4.5	4.4	4.6	5.0	6.5
5	6.1	5.7	5.4	7.7	6.4	5.7	5.0	4.5	4.4	4.6	5.1	6.4
6	6.5	5.6	5.4	7.8	6.4	5.7	5.0	4.5	4.5	4.7	5.0	6.3
7	6.6	5.6	5.4	8.1	6.4	5.5	4.9	4.5	4.5	4.9	5.1	6.2
8	6.2	5.5	5.3	8.5	6.3	5.6	4.9	4.5	4.6	5.0	5.3	6.2
9	6.4	5.5	5.2	9.1	6.3	5.6	4.9	4.5	4.8	5.0	5.3	6.1
10	6.2	5.5	5.2	9.4	6.1	5.6	4.9	4.4	4.9	5.0	5.5	6.0
11	6.2	5.4	5.1	9.5	5.9	5.7	4.9	4.5	4.9	5.1	5.5	6.0
12	6.1	5.3	5.1	9.4	5.9	5.7	4.8	4.5	4.9	5.1	5.9	6.2
13	6.1	5.2	5.1	9.1	5.8	5.6	4.8	4.5	4.9	5.1	5.7	6.2
14	6.1	5.2	5.1	9.1	5.7	5.5	4.7	4.4	4.9	5.1	5.7	6.6
15	6.1	5.2	5.5	9.1	5.5	5.5	4.7	4.4	5.0	5.1	5.7	7.0
16	6.1	5.1	6.2	9.0	5.4	5.4	4.7	4.4	5.0	5.1	5.7	7.4
17	6.1	5.1	6.6	8.9	5.4	5.3	4.7	4.4	4.9	5.1	5.7	7.4
18	6.0	5.0	6.1	8.5	5.4	5.3	4.7	4.4	4.9	5.1	5.7	7.5
19	6.0	5.0	6.1	8.4	5.4	5.4	4.7	4.4	4.9	5.1	6.0	7.4
20	5.9	5.1	6.0	8.1	5.4	5.3	4.7	4.4	4.9	5.1	6.0	7.2
21	5.8	5.1	6.0	8.1	5.5	5.3	4.7	4.4	4.9	5.0	6.1	7.2
22	5.7	5.1	6.0	8.0	5.6	5.3	4.7	4.4	4.9	5.0	6.1	7.2
23	5.7	5.1	6.1	7.7	5.8	5.3	4.7	4.4	4.9	5.0	6.1	7.0
24	5.7	5.1	6.3	7.5	6.0	5.2	4.7	4.4	4.8	5.0	6.1	6.9
25	5.6	5.1	6.1	7.3	6.0	5.2	5.0	4.4	4.8	5.0	6.2	6.9
26	5.5	5.1	6.0	7.0	6.2	5.2	4.6	4.4	4.8	5.0	6.0	6.7
27	5.5	5.1	6.3	6.7	6.3	5.2	4.6	4.4	4.8	5.0	6.0	6.6
28	5.5	5.1	7.3	6.6	6.3	5.2	4.5	4.4	4.7	5.0	6.1	6.4
29	5.3	.....	7.8	6.5	6.4	5.1	4.5	4.4	4.7	5.0	6.2	6.4
30	5.3	.....	8.5	6.3	6.3	5.1	4.5	4.4	4.7	4.9	6.3	6.7
31	5.7	.....	8.6	.....	6.2	.....	4.5	4.4	.....	4.9	.....	6.5

NOTE.—Relation of gage height to discharge at this station not affected by ice.

Daily discharge, in second-feet, of Oswegatchie River near Ogdensburg, N. Y., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,570	2,640	1,570	11,200	4,310	3,730	1,380	450	330	720	1,030	4,890
2	1,570	2,640	1,570	10,300	4,600	3,440	1,380	450	330	580	1,030	4,890
3	1,770	2,640	1,970	9,660	4,310	2,890	1,380	450	330	580	1,200	4,890
4	3,160	2,640	2,180	9,350	4,600	2,640	1,380	450	330	580	1,200	4,890
5	3,730	2,640	1,970	8,450	4,600	2,640	1,200	450	330	580	1,380	4,600
6	4,890	2,400	1,970	8,750	4,600	2,640	1,200	450	450	720	1,200	4,310
7	5,180	2,400	1,970	9,660	4,600	2,180	1,030	450	450	1,030	1,380	4,020
8	4,020	2,180	1,770	10,900	4,310	2,400	1,030	450	580	1,200	1,770	4,020
9	4,600	2,180	1,570	12,700	4,310	2,400	1,030	450	870	1,200	1,770	3,730
10	4,020	2,180	1,570	13,600	3,730	2,400	1,030	330	1,030	1,200	2,180	3,440
11	4,020	1,970	1,380	14,000	3,160	2,640	1,030	450	1,030	1,380	2,180	3,440
12	3,730	1,770	1,380	13,600	3,160	2,640	870	450	1,030	1,380	3,160	4,020
13	3,730	1,570	1,380	12,700	2,890	2,400	870	450	1,030	1,380	2,640	4,020
14	3,730	1,570	1,380	12,700	2,640	2,180	720	330	1,030	1,380	2,640	5,180
15	3,730	1,570	2,180	12,700	2,180	2,180	720	330	1,200	1,380	2,640	6,360
16	3,730	1,380	4,020	12,400	1,970	1,970	720	330	1,200	1,380	2,640	7,550
17	3,730	1,380	5,180	12,100	1,970	1,770	720	330	1,030	1,380	2,640	7,550
18	3,440	1,200	3,730	10,900	1,970	1,770	720	330	1,030	1,380	2,640	7,850
19	3,440	1,200	3,730	10,600	1,970	1,970	720	330	1,030	1,380	3,440	7,550
20	3,160	1,380	3,440	9,660	1,970	1,770	720	330	1,030	1,380	3,440	6,960
21	2,890	1,380	3,440	9,660	2,180	1,770	720	330	1,030	1,200	3,730	6,960
22	2,640	1,380	3,440	9,350	2,400	1,770	720	330	1,030	1,200	3,730	6,960
23	2,640	1,380	3,730	8,450	2,890	1,770	720	330	1,030	1,200	3,730	6,360
24	2,640	1,380	4,310	7,850	3,440	1,570	720	330	870	1,200	3,730	6,070
25	2,400	1,380	3,730	7,250	3,440	1,570	1,200	330	870	1,200	4,020	6,070
26	2,180	1,380	3,440	6,360	4,020	1,570	580	330	870	1,200	3,440	5,480
27	2,180	1,380	4,310	5,480	4,310	1,570	580	330	870	1,200	3,440	5,180
28	2,180	1,380	7,250	5,180	4,310	1,570	450	330	720	1,200	3,730	4,600
29	1,770	.....	8,750	4,890	4,600	1,380	450	330	720	1,200	4,020	4,600
30	1,770	.....	10,900	4,310	4,310	1,380	450	330	720	1,030	4,310	5,480
31	2,640	.....	11,200	.....	4,020	.....	450	330	.....	1,030	.....	4,890

NOTE.—Daily discharge determined from a fairly well defined discharge rating curve.

Monthly discharge of Oswegatchie River near Ogdensburg, N. Y., for 1911.

[Drainage area, 1,580 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	5,180	1,570	3,120	2.97	3.42	B.
February	2,640	1,200	1,810	1.15	1.20	B.
March	11,200	1,380	3,560	2.25	2.59	A.
April	14,000	4,310	9,820	6.22	6.94	A.
May	4,600	1,970	3,480	2.20	2.54	A.
June	3,730	1,380	2,150	1.36	1.52	A.
July	1,380	450	867	.549	.63	B.
August	450	330	376	.238	.27	B.
September	1,200	330	813	.515	.57	B.
October	1,380	580	1,130	.715	.82	B.
November	4,310	1,030	2,670	1.69	1.89	A.
December	7,850	3,440	5,380	3.41	3.93	A.
The year	14,000	330	2,930	1.85	26.32	

RAQUETTE RIVER AND TRIBUTARIES.

RAQUETTE RIVER AT RAQUETTE FALLS, NEAR COREYS, N. Y.

Location.—6 miles above Axton, 5 miles below the outlet of Long Lake and 2 miles below the mouth of Moose Creek.

Records available.—August 27, 1908, to December 31, 1911. Published also in annual reports of New York State Water-Supply Commission and New York State engineer and surveyor.

Drainage area.—418 square miles.

Gage.—A staff fastened to the right bank in a comparatively smooth section between two small falls; read once daily during the open-water period and weekly during the ice period; datum unchanged since station was established.

Channel.—Rough, composed of large bowlders; permanent; one channel at all stages.

Discharge measurements.—Made from a car and cable about 10 feet above the gage.

Winter flow.—Relation of gage height to discharge somewhat affected by ice.

Accuracy.—Low-water section of discharge curve well defined; but few measurements have been made at high water, and determinations of flow for stages above gage height 5 feet may be somewhat in error.

Cooperation.—Established and maintained in cooperation with the State Water Supply Commission of New York.

The discharge at this station added to that of Bog River near Tupper Lake shows in a general way the amount of water flowing into Tupper Lake, a study of which is being made to determine the amount of storage feasible in the lake. The combined drainage areas equal about 75 per cent of the drainage at Piercefield.

The following measurement was made by W. G. Hoyt:

February 22, 1911: Gage height, 2.11 feet; discharge, 336 second-feet.

There was ice along the shore but the relation of gage height to discharge was not affected thereby.

Daily gage height, in feet, of Raquette River at Raquette Falls, near Coreys, N. Y., for 1911.

[C. A. De Lancett, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	2.9	6.1	4.4	2.8	1.2	1.4	1.6	2.5	3.1
2	.....	.....	.....	2.8	6.3	4.4	2.7	1.2	1.4	1.8	2.5	3.1
3	.....	.....	.....	2.7	6.6	4.3	2.7	1.1	1.3	1.9	2.5	3.0
4	.....	2.5	2.0	2.7	6.4	4.2	2.6	1.1	1.2	2.0	2.5	3.0
5	.....	.....	.....	2.8	6.2	4.2	2.5	1.1	1.2	2.5	2.5	3.0
6	.....	.....	.....	2.8	6.0	4.2	2.4	1.1	1.2	2.5	2.6	3.0
7	3.4	.....	.....	3.1	5.9	4.1	2.3	1.1	2.2	2.5	2.6	3.0
8	.....	.....	.....	3.2	5.7	4.1	2.2	1.1	2.2	2.5	2.7	2.9
9	.....	.....	.....	3.4	5.4	4.0	2.2	1.0	1.9	2.5	2.7	2.9
10	.....	.....	.....	3.4	5.4	3.9	2.1	1.0	1.9	2.5	2.8	2.9
11	.....	2.2	1.9	3.5	5.3	3.4	2.1	1.1	1.8	2.5	2.8	3.2
12	.....	.....	.....	3.5	5.2	3.4	1.9	1.1	1.8	2.5	2.8	3.5
13	.....	.....	.....	3.6	5.1	3.4	1.8	1.0	2.0	2.4	2.9	4.0
14	3.4	.....	.....	3.8	5.0	3.7	1.7	1.0	2.0	2.4	2.9	4.4
15	.....	.....	.....	4.1	4.9	3.7	1.7	1.0	1.9	2.4	3.9	4.4
16	.....	.....	.....	4.4	4.8	3.9	1.6	1.0	1.9	2.4	2.9	4.4
17	.....	.....	.....	4.5	4.8	4.0	1.6	1.0	1.8	2.4	2.9	4.5
18	.....	2.2	1.8	4.7	4.7	4.0	1.7	1.0	1.8	2.5	3.0	4.4
19	.....	.....	.....	4.7	4.7	3.7	1.8	1.3	1.8	2.6	3.0	4.3
20	.....	.....	.....	4.6	5.0	3.6	1.7	1.3	1.7	2.6	3.0	4.2
21	2.4	.....	.....	4.6	4.9	3.5	1.6	1.2	1.7	2.6	3.0	4.2
22	.....	2.1	.....	4.6	4.7	3.5	1.5	1.2	1.7	2.7	3.0	4.1
23	.....	.....	.....	4.7	4.7	3.4	1.4	1.2	1.7	2.7	3.1	4.1
24	.....	.....	.....	4.7	5.5	3.4	1.4	1.1	1.7	2.7	3.1	4.1
25	.....	2.1	2.2	4.8	5.5	3.3	1.4	1.1	1.6	2.7	3.1	4.2
26	.....	.....	.....	4.9	5.1	3.3	1.4	1.1	1.6	2.6	3.0	4.2
27	.....	.....	.....	5.2	4.7	3.3	1.4	1.0	1.6	2.6	3.0	4.3
28	2.2	.....	.....	5.4	4.7	3.2	1.4	1.0	1.6	2.6	3.0	4.1
29	.....	.....	.....	5.4	4.6	3.0	1.3	1.8	1.6	2.5	3.1	4.0
30	.....	.....	.....	5.9	4.4	2.9	1.3	1.7	1.5	2.5	3.1	3.9
31	.....	.....	.....	.....	4.3	.....	1.3	1.5	.....	2.5	.....	3.7

NOTE.—Extent to which the gage heights were affected by ice somewhat uncertain. Probably, however, more or less backwater from ice from about Jan. 1 to about Feb. 10. The measurement made Feb. 22 indicated no backwater due to ice. Gage readings probably to water surface. Probably backwater from a log jam during the later part of May and the first part of June. When the log jam was removed June 10 to 11, there was a sudden drop in stage, indicating approximately 0.5 foot of backwater from this cause during the first part of June.

Daily discharge, in second-feet, of Raquette River at Raquette Falls, near Coreys, N. Y., for 1911.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	300	655	4,220	1,860	600	110	150	190	460	770
2	.....	290	600	4,540	1,860	550	110	150	240	460	770
3	.....	290	550	5,030	1,750	550	90	130	265	460	710
4	.....	290	550	4,700	1,640	505	90	110	290	460	710
5	.....	280	600	4,380	1,640	460	90	110	460	460	710
6	.....	280	600	4,060	1,640	420	90	110	460	505	710
7	.....	270	770	3,900	1,540	385	90	350	460	505	710
8	.....	270	830	3,580	1,540	350	90	350	460	550	655
9	.....	265	970	3,130	1,450	350	70	265	460	550	655
10	.....	265	970	3,130	1,360	320	70	265	460	600	655
11	350	265	1,040	2,980	970	320	90	240	460	600	830
12	350	250	1,040	2,840	970	265	90	240	460	600	1,040
13	350	250	1,120	2,700	970	240	70	290	420	655	1,450
14	350	250	1,280	2,570	1,200	215	70	290	420	655	1,860
15	350	250	1,540	2,440	1,200	215	70	265	420	1,360	1,860
16	350	240	1,860	2,320	1,360	190	70	265	420	655	1,860
17	350	240	1,970	2,320	1,450	190	70	240	420	655	1,970
18	350	240	2,200	2,200	1,450	215	70	240	460	710	1,860
19	340	240	2,200	2,200	1,200	240	130	240	505	710	1,750
20	330	250	2,080	2,570	1,120	215	130	215	505	710	1,640

Daily discharge, in second-feet, of Raquette River at Raquette Falls, near Coreys, N. Y., for 1911—Continued.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	320	260	2,080	2,440	1,040	190	110	215	505	710	1,640
22	320	270	2,080	2,200	1,040	170	110	215	550	710	1,540
23	320	280	2,200	2,200	970	150	110	215	550	770	1,540
24	320	300	2,200	3,280	970	150	90	215	550	770	1,540
25	320	350	2,320	3,280	900	150	90	190	550	770	1,640
26	320	380	2,440	2,700	900	150	90	190	505	710	1,640
27	320	400	2,840	2,200	900	150	70	190	505	710	1,750
28	320	450	3,130	2,200	830	150	70	190	505	710	1,540
29	.....	500	3,130	2,080	710	130	240	190	460	770	1,450
30	.....	550	3,900	1,860	655	130	215	170	460	770	1,360
31	.....	600	.....	1,750	.....	130	170	.....	460	.....	1,200

NOTE.—Daily discharge determined from a fairly well defined discharge rating curve. The open-channel rating curve has been applied throughout the period Feb. 11 to Dec. 31, with no corrections for possible backwater from ice or from log jams. Discharge interpolated for periods when the gage was not read.

Monthly discharge of Raquette River at Raquette Falls, near Coreys, N. Y., for 1911.

[Drainage area, 418 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	373	0.892	1.03	C.
February	.....	.....	341	.816	.85	C.
March	600	240	311	.744	.86	B.
April	3,900	550	1,660	3.97	4.43	A.
May	5,030	1,750	2,970	7.11	8.20	A.
June	1,860	655	1,240	2.97	3.31	A.
July	600	130	272	.651	.75	A.
August	240	70	101	.242	.28	B.
September	350	110	216	.517	.58	A.
October	550	190	446	1.07	1.23	A.
November	1,360	460	657	1.57	1.75	A.
December	1,970	655	1,290	3.09	3.56	A.
The year	5,030	70	825	1.97	26.83	

NOTE.—Discharge for Jan. 1 to Feb. 10 was estimated from climatologic records and the discharge at other stations in the Raquette River basin. Mean discharge Feb. 1 to 10 estimated 350 second-feet.

RAQUETTE RIVER AT PIERCEFIELD, N. Y.

Location.—About three-fourths of a mile above the head of Black Rapids and half a mile below the dam of International Paper Co. at Piercefield.

Records available.—August 20, 1908, to December 31, 1911. Published also in annual reports of State Water Supply Commission, New York State Conservation Commission, and New York State engineer and surveyor.

Drainage area.—723 square miles.

Gage.—From August 20, 1908, to September 3, 1910, a vertical staff fastened to a large pine stump in a pond like stretch of the stream controlled by Black Rapids; after September 3, 1910, chain gage fastened to same stump. Both gages installed at same datum, which has remained unchanged.

Channel.—Permanent.

Discharge measurements.—Made at low and medium stages from a boat just above Black Rapids; at high stages made from the highway bridge about three-fourths mile above the station and one-fourth mile above the dam of the International Paper Co.

Winter flow.—The rapids controlling the stream at the gage rarely freeze and measurements made with ice present indicate that the relation between gage height and discharge is little if any affected by ice. Open-water discharge rating curve usually applicable throughout the year.

Artificial control.—The dam of the International Paper Co. controls the flow of the stream at the station during low-water periods, but the mill is usually run for 24 hours each day except Sundays. The numerous lakes in the upper part of the drainage basin afford considerable storage, most of which is controlled.

Accuracy.—Although the discharge at this station is somewhat affected by artificial control, the records are believed to be good.

Discharge measurements of Raquette River at Piercefield, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 23[a]	F. J. Shuttleworth	5.10	888
June 30	G. H. Canfield	5.40	1,060
Sept. 10[b]	do	1.54	51.6

[a] Measurement made under complete ice cover about 4 miles below gage. Average thickness of ice 0.93 foot. Ice at gage section, complete cover. Average thickness of ice about 2.5 feet. Control point free from ice cover; some ice on rocks and side.

[b] Measurement made by wading about 300 yards below boat section.

Daily gage height, in feet, of Raquette River at Piercefield, N. Y., for 1911.

[W. B. Graves, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.0	4.7	5.2	4.9	10.4	7.6	5.6	5.5	3.3	1.10	3.8	5.6
2	3.5	4.9	5.2	2.0	10.4	7.6	2.7	5.1	3.4	2.9	4.0	5.6
3	4.0	5.1	5.2	5.0	10.3	7.5	4.3	3.7	3.5	3.9	4.0	5.7
4	4.1	5.2	5.2	5.6	10.4	4.3	5.0	2.6	3.6	3.7	3.9	5.9
5	4.1	2.0	2.0	5.7	10.4	6.3	5.4	2.4	3.8	3.6	1.45	5.9
6	4.1	4.0	3.5	5.5	10.4	6.4	5.4	2.05	4.0	3.6	2.4	6.0
7	4.1	5.2	4.0	5.6	10.1	6.4	5.4	2.10	3.9	3.5	3.2	6.0
8	2.0	5.4	4.2	5.8	9.7	6.4	5.4	3.45	3.8	.95	4.0	6.0
9	3.5	5.4	4.2	5.6	9.8	6.4	2.4	3.7	3.7	2.3	4.2	6.0
10	5.0	5.4	4.1	6.2	9.6	6.4	4.2	4.0	1.7	2.6	4.1	3.8
11	5.0	5.4	4.2	6.4	9.5	5.2	4.5	4.0	1.55	2.7	4.0	5.9
12	5.0	2.0	2.0	6.4	9.4	6.5	4.4	4.0	2.35	2.8	1.9	6.0
13	5.0	3.1	3.5	6.4	9.4	6.5	4.3	1.85	4.2	2.8	5.8	6.1
14	5.0	4.3	4.2	6.4	9.0	6.5	4.4	2.2	4.3	2.95	5.4	6.1
15	2.0	4.7	4.1	6.3	9.1	6.5	4.4	2.15	4.4	1.05	5.2	6.2
16	3.5	4.7	4.2	6.1	9.0	6.4	2.5	3.9	4.4	3.6	5.0	6.3
17	5.0	4.7	4.1	6.5	8.9	6.4	3.25	4.0	2.5	4.0	4.9	7.8
18	5.0	4.7	4.2	6.6	8.8	5.2	3.9	2.15	3.4	4.1	5.0	7.8
19	5.0	2.0	2.0	6.6	8.6	6.2	4.2	1.95	3.9	4.0	2.65	7.5
20	5.0	3.7	3.5	6.7	8.6	6.3	4.2	1.75	4.0	4.0	5.5	7.5
21	5.0	5.2	4.2	6.8	7.2	6.3	4.2	1.9	4.0	4.1	5.9	7.4
22	2.0	5.2	4.2	6.5	7.6	6.3	4.5	4.0	3.4	2.3	5.8	7.5
23	4.9	5.2	4.1	7.8	7.6	6.4	2.7	4.0	3.3	3.2	5.9	7.4
24	4.8	5.2	4.2	8.3	7.8	6.3	4.0	2.2	1.35	3.8	5.9	6.7
25	4.9	5.2	4.2	8.5	7.7	4.2	4.2	2.1	3.0	4.0	5.9	6.5
26	5.0	2.0	2.0	8.7	7.6	5.3	3.8	2.0	3.8	4.0	5.3	7.6
27	5.0	5.2	3.6	8.8	7.6	6.0	3.6	1.9	3.7	4.0	5.3	7.6
28	4.8	5.2	5.0	8.8	7.3	6.1	2.7	3.45	3.6	3.8	5.6	7.1
29	2.0	.....	4.9	8.5	7.4	6.1	2.55	3.3	3.6	2.35	5.6	7.1
30	3.5	.....	5.0	8.7	7.6	5.6	2.35	3.2	3.5	2.85	5.6	7.1
31	4.0	.....	4.9	.....	7.6	.....	4.5	3.25	.....	3.7	.....	7.1

NOTE.—Relation of gage height to discharge not usually affected by ice at this station. The gage readings are taken in a pond above a swift control point which usually remains open throughout the winter. Gage readings probably to water surface. The fluctuation of the gage heights is under the control of the paper mill above the station.

Daily discharge, in second-feet, of Raquette River at Piercefield, N. Y., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	88	730	940	810	5,880	2,750	1,160	1,100	290	28	425	1,160
2	342	810	940	88	5,880	2,750	161	895	316	196	485	1,160
3	485	895	940	850	5,750	2,650	580	397	342	455	485	1,220
4	515	940	940	1,160	5,880	580	850	147	369	397	455	1,350
5	515	88	88	1,220	5,880	1,630	1,040	124	425	369	47	1,350
6	515	485	342	1,100	5,880	1,700	1,040	92	485	369	124	1,420
7	515	940	485	1,160	5,500	1,700	1,040	96	455	342	265	1,420
8	88	1,040	545	1,280	5,020	1,700	1,040	329	425	22	485	1,420
9	342	1,040	545	1,160	5,140	1,700	124	397	397	114	545	1,420
10	850	1,040	515	1,560	4,900	1,700	545	485	64	147	515	425
11	850	1,040	545	1,700	4,780	940	650	485	54	161	485	1,350
12	850	88	88	1,700	4,660	1,780	615	485	118	177	80	1,420
13	850	241	342	1,700	4,660	1,780	580	76	545	177	1,280	1,490
14	850	580	545	1,700	4,200	1,780	615	105	580	207	1,040	1,490
15	88	730	515	1,630	4,320	1,780	615	100	615	26	940	1,560
16	342	730	545	1,490	4,200	1,700	135	455	615	369	850	1,630
17	850	730	515	1,780	4,090	1,700	278	485	135	485	810	2,950
18	850	730	545	1,860	3,980	940	455	100	316	515	850	2,950
19	850	88	88	1,860	3,760	1,560	545	84	455	485	154	2,650
20	850	397	342	1,940	3,760	1,630	545	68	485	485	1,100	2,650
21	850	940	545	2,020	2,380	1,630	545	80	485	515	1,350	2,560
22	88	940	545	1,780	2,750	1,630	650	485	316	114	1,280	2,650
23	810	940	515	2,950	2,750	1,700	161	485	290	265	1,350	2,560
24	770	940	545	3,450	2,950	1,630	485	105	41	425	1,350	1,940
25	810	940	545	3,660	2,850	545	545	96	218	485	1,350	1,780
26	850	88	88	3,870	2,750	990	425	88	425	485	990	2,750
27	850	940	369	3,980	2,750	1,420	369	80	397	485	990	2,750
28	770	940	850	3,980	2,470	1,490	161	329	369	425	1,160	2,290
29	88	.....	810	3,660	2,560	1,490	141	290	369	119	1,160	2,290
30	342	.....	850	3,870	2,750	1,160	119	265	342	186	1,160	2,290
31	485	.....	810	.....	2,750	.....	650	278	.....	397	.....	2,290

NOTE.—Daily discharge determined from a well-defined discharge rating curve. The accuracy of the daily discharge is not greatly affected by the operation of the mill above the station, as the plant runs continuously except occasionally on Sundays or other times when it is closed for repairs.

Monthly discharge of Raquette River at Piercefield, N. Y., for 1911.

[Drainage area, 723 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	850	88	587	0.812	0.94	B.
February	1,040	88	715	.989	1.03	B.
March	945	88	543	.751	.87	B.
April	3,980	88	2,030	2.81	3.14	A.
May	5,880	2,380	4,120	5.71	6.58	A.
June	2,750	580	1,600	2.22	2.48	A.
July	1,160	119	544	.752	.87	B.
August	1,100	76	293	.405	.47	B.
September	615	41	358	.495	.55	B.
October	515	22	304	.420	.48	B.
November	1,350	47	785	1.09	1.22	B.
December	2,950	425	1,890	2.61	3.01	A.
The year	5,880	22	1,150	1.59	21.64	

RAQUETTE RIVER AT MASSENA SPRINGS, N. Y.

Location.—At highway bridge at Massena Springs, N. Y., 1,000 feet above the New York Central & Hudson River Railroad bridge used for freight transfer from the railroad station to the Massena power plant, one-fourth mile from the New York Central & Hudson River Railroad station on the highway bridge leading to Massena, 8 miles below Raymondville, and 10 miles above the mouth of the stream.

Records available.—September 21, 1903, to October 17, 1903; April 9, 1904, to December 31, 1911; data also in annual reports of New York State engineer and surveyor, New York State Water Supply Commission, and New York State Conservation Commission.

Drainage area.—1,170 square miles.

Gage.—Original gage a vertical staff fastened to a stone wall on the left bank 25 feet upstream from the bridge. Staff gage was replaced August 16, 1906, by a standard chain gage fastened to upstream side of highway bridge. The datum of the chain gage was made 1 foot lower than the staff gage in order to avoid negative readings. During the summer and fall of 1911 a new concrete bridge was constructed just below the old bridge. During the period of construction gage readings were obtained from a temporary staff gage fastened to the railroad bridge. Readings were also made at the regular gage, and special discharge measurements were made to develop the proper discharge rating curves for this period.

Channel.—Bed of river of coarse gravel and small bowlders; permanent; current good at all points; formerly one channel, now two; slight correction necessary for angle.

Discharge measurements.—Previous to construction of new bridge, made from upstream side of highway bridge; no measurements have yet been made from new bridge. The new bridge has two spans and will undoubtedly cause some change in the discharge rating curve.

Artificial control.—The operation of a number of power plants above the station has marked effect on the low-water discharge of the stream. These plants are usually run for 24-hour power but are closed on Sundays. The effect of the Sunday closing is shown in the stream for several days.

Winter flow.—Ice forms at this station to a thickness of 3 feet and considerably affect the relation of gage height to discharge for December, January, February, and March.

Accuracy.—Determinations of monthly discharge considered good, but those of daily discharge may be considerably in error for low-water periods due to artificial control. Monthly estimates for periods during which ice is present also subject to large errors.

Cooperation.—Maintained in cooperation with New York State Conservation Commission.

Discharge measurements of Raquette River at Massena Springs, N. Y., in 1911.

Date.	Hydrographer.	Mean gage height.[a]	Discharge.
1911.		*Feet.*	*Sec.-ft.*
Feb. 20[b]	W. G. Hoyt	4.48	969
Apr. 12[c]	C. S. De Golyer	9.51	4,790
July 3	G. H. Canfield	2.79	1,050
Sept. 8	do	1.80	387
11	do	[d] 1.84	406
12	do	[e] 2.66	868
12	do	[f] 2.30	612
Nov. 21	C. S. De Golyer	[g] 4.30	1,850

[a] Chain gage.
[b] Measurement made under complete ice cover.
[c] Gage height, top of ice, 4.58 feet. Average thickness of ice, 2.24 feet. Open water at bridge. Ice jammed below and above, causing backwater.
[d] Gage height, staff gage, 2.84 feet.
[e] Gage height, staff gage, 3.30 feet.
[f] Gage height, staff gage, 3.64 feet.
[g] Gage height, staff gage, 4.99 feet.

Daily gage height, in feet, of Raquette River at Massena Springs, N. Y., for 1911.

[Fred L. Babcock, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.6			5.9	8.4	5.6	3.6	1.8	1.75	2.8	3.7	5.4
2					9.2	5.5	3.3	2.05	2.05	3.8	3.35	5.2
3					9.4	5.6	3.0	1.85	1.7	3.5	3.9	4.8
4			4.6		9.4	5.2	3.0	1.75	1.8	3.2	3.9	6.2
5		4.7			9.2	5.2	3.0	1.5	1.75	3.2	3.7	6.5
6					9.0	4.8	3.4	1.65	2.0	3.1	3.25	5.8
7	4.5				8.8	4.8	3.2	1.8	1.85	3.6	3.9	6.1
8				10.5	9.0	4.6	2.8	1.85	1.75	3.4	4.0	5.2
9					8.7	4.4	2.25	2.0	1.8	3.7	3.7	5.0
10					8.4	4.6	2.2	1.85	2.8	4.3	4.3	5.0
11			4.8		8.0	4.0	3.0	1.75	1.8	3.6	4.4	5.4
12		4.7		9.4	7.8	4.4	3.1	1.55	3.35	3.6	4.4	5.6
13				9.2	7.4	4.4	2.8	1.75	3.3	3.0	3.6	5.7
14				8.6	7.2	4.6	1.85	1.75	3.1	3.6	4.2	7.1
15	4.5			8.2	6.9	4.4	1.75	1.85	3.25	2.95	4.4	7.0
16				8.0	6.7	4.4	1.75	1.85	3.85	2.8	4.0	7.1
17				8.0	6.6	4.3	2.0	2.05	3.85	3.3	4.2	6.8
18			5.1	7.6	6.4	4.2	3.1	1.82	2.9	3.4	4.7	6.8
19		4.6		7.4	6.3	4.4	2.7	1.75	3.15	3.6	5.1	5.8
20				7.4	6.2	4.0	2.6	1.75	3.3	3.3	5.5	5.7
21				7.4	5.8	4.1	2.5	1.45	3.15	3.3	5.2	5.6
22	4.4			7.4	5.6	4.1	2.8	1.55	2.9	3.35	4.8	5.4
23				7.2	5.35	4.1	1.9	1.85	2.85	3.25	4.8	5.8
24				7.2	5.4	4.0	1.55	1.9	2.9	3.6	4.6	6.0
25		4.7	5.3	7.1	7.6	3.6	1.7	1.95	3.1	3.8	5.2	6.0
26				7.2	7.6	3.8	2.45	1.9	3.5	3.6	5.0	6.0
27				7.6	7.0	3.8	2.35	1.7	3.1	3.4	4.6	5.6
28				7.8	6.4	3.8	2.0	1.6	2.9	3.8	4.8	5.6
29	4.4			8.0	6.3	3.7	1.85	1.75	3.0	3.6	4.8	7.7
30				8.1	6.0	3.65	1.65	1.75	2.85	3.9	4.9	8.8
31					5.8		1.65	1.85		3.8		8.6

NOTE.—Relation of gage height to discharge affected by ice from Jan. 1 to about Apr. 16 and from about Dec. 29 to 31. Gage heights to water surface, except those for Jan. 1 and 7, which are to the top of the ice. From about July 1 to Dec. 13 the gage heights read from the chain gage were affected by construction work at the new bridge. Some uncertainty also exists regarding the gage heights from Dec. 19 to 31, owing to the possibility of a permanent change in the relation of gage height to discharge, caused by the construction work at the bridge, which was completed on Dec. 13. All gage readings were taken on the chain gage, except for the periods Sept. 12 to Dec. 3 and Dec. 7 to 18, when they were read from a temporary staff gage established on the railroad bridge below the bridge to which the chain gage is attached.

Daily discharge, in second-feet, of Raquette River at Massena Springs, N. Y., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		7,160	3,680	1,660	465	365	385	875	2,200
2		8,350	3,580	1,420	592	505	945	662	2,020
3		8,650	3,680	1,200	490	345	750	1,020	1,690
4		8,650	3,280	1,200	442	385	580	1,020	3,650
5		8,350	3,280	1,200	335	365	580	875	4,000
6		8,050	2,880	1,500	398	480	530	608	3,250
7		7,750	2,880	1,350	465	408	810	1,020	2,900
8		8,050	2,700	1,060	490	365	690	1,080	2,020
9		7,600	2,500	705	565	385	875	875	1,850
10		7,160	2,700	675	490	945	1,300	1,300	1,850
11		6,590	2,140	1,200	442	385	810	1,380	2,200
12	4,800	6,310	2,500	1,280	355	662	810	1,380	2,400
13	5,000	5,780	2,500	1,060	442	635	480	810	2,500
14	5,500	5,520	2,700	490	442	530	810	1,230	4,040
15	6,000	5,150	2,500	442	490	608	455	1,380	3,920
16	6,200	4,910	2,500	442	490	980	385	1,080	4,040
17	6,590	4,790	2,420	565	592	980	635	1,230	3,680
18	6,040	4,560	2,320	1,280	475	430	690	1,610	3,680
19	5,780	4,440	2,500	990	442	555	810	1,940	3,680
20	5,780	4,330	2,140	925	442	635	635	2,300	3,560

Daily discharge, in second-feet, of Raquette River at Massena Springs, N. Y., for 1911 Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	5,780	3,890	2,240	860	315	555	635	2,020	3,450
22	5,780	3,680	2,240	1,060	355	430	662	1,690	3,230
23	5,520	3,420	2,240	515	408	408	608	1,690	3,680
24	5,520	3,480	2,140	355	430	430	810	1,530	3,920
25	5,400	6,040	1,800	420	455	530	945	2,020	3,920
26	5,520	6,040	1,960	828	430	750	810	1,850	3,920
27	6,040	5,270	1,960	765	345	530	690	1,530	3,450
28	6,310	4,560	1,960	565	305	430	945	1,690	3,450
29	6,590	4,440	1,880	490	365	480	810	1,690	3,300
30	6,730	4,110	1,840	398	365	408	1,020	1,770	3,200
31	.....	3,890	.....	398	408	.....	945	.....	3,000

NOTE.—Daily discharge determined by means of four discharge rating curves: (1) A well-defined curve, used during 1910, applicable for the open-water period until June 30; (2) a rating curve based on a measurement made July 3, applicable July 1 to Aug. 22, curve only fairly well defined and period of application uncertain; (3) a well-defined curve constructed from four measurements made during September, and applicable, though with some uncertainty regarding the period, from Aug. 23 to Sept. 11, and (4) a well-defined curve constructed from measurements made during September and November, and applicable to the staff gage readings Sept. 12 to Dec. 3 and Dec. 7 to 18; also applicable to chain gage readings Dec. 4 to 6 and Dec. 19 to 31, with a correction of +0.6 foot for Dec. 4 to 6 and +1.0 foot for Dec. 19–31. Daily discharge May 13 to 16 and Dec. 29 to 31 estimated.

Monthly discharge of Raquette River at Massena Springs, N. Y., for 1911.

[Drainage area, 1,170 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	1,400	1.20	1.38	D.
February	.....	.....	1,200	1.03	1.07	C.
March	.....	.....	1,350	1.15	1.33	C.
April	6,730	.....	4,800	4.10	4.57	B.
May	8,650	3,420	5,840	4.99	5.75	A.
June	3,680	1,800	2,520	2.15	2.40	A.
July	1,660	355	881	.753	.87	B.
August	592	305	436	.373	.43	B.
September	980	345	530	.453	.51	A.
October	1,300	385	737	.630	.73	A.
November	2,300	608	1,370	1.17	1.30	A.
December	4,040	1,690	3,150	2.69	3.10	B.
The year	8,650	305	2,020	1.73	23.44	

NOTE.—Discharge Jan. 1 to Apr. 11 determined from the discharge at Piercefield plus an inflow between Piercefield and Massena Springs estimated from consideration of general conditions affecting run-off in northern New York. Mean discharge Apr. 1 to 11 estimated 3,000 second-feet.

BOG RIVER NEAR TUPPER LAKE, N. Y.

Location.—Mouth of Bog River, head of Tupper Lake, 1½ miles below the junction of Bog River and the outlet from Round Pond.

Records available.—August 24, 1908, to December 31, 1911. Published also in annual reports of the New York State Water-Supply Commission and the New York State engineer and surveyor.

Drainage area.—132 square miles.

Gage.—Staff, fastened to the left wing wall of an unused dam; read once daily; datum unchanged since established.

Channel.—Possibly shifting, as the bed is composed of rock on one side and gravel on the other. The crest of the dam with the brink of the adjacent falls forms a control point considered permanent.

Discharge measurements.—Made from a car and cable about 1½ miles above the gage and immediately below the mouth of the outlet from Round Pond.

Artificial control.—The flow is more or less regulated during the spring for log driving. The operation of a small power plant on the main stream causes some variation in the daily gage heights during the low-water periods in the summer.

Winter flow.—The gage heights are usually not observed during December to March on account of ice.

Accuracy.—Low-water portion of the discharge curve well developed. As few higher measurements have been made, determinations of discharge for stages above gage height 4 feet may be somewhat in error.

Cooperation.—Established and maintained in cooperation with the Water Supply Commission of the State of New York.

Bog River and its tributary drain a number of small lakes and ponds, among which are Higgens First, Second, and Third ponds on Bog River, and Round Pond and Little Tupper Lake on the tributary, all of which lie south and southwest of Big Tupper Lake. The station is important, in connection with stations on the Raquette at Raquette Falls and Piercefield, to the study of storage feasible in Tupper Lake.

Daily gage height, in feet, of Bog River near Tupper Lake, N. Y., for 1911.

[B. O. Lott, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	4.5	3.0	2.0	1.1	1.0	1.3	1.4
2	2.1	4.9	3.0	2.0	1.1	1.0	1.3	1.4
3	2.1	4.9	2.8	1.9	1.0	1.0	1.3	1.4
4	2.2	4.8	2.8	1.8	1.0	1.0	1.3	1.4
5	2.4	4.8	2.8	1.7	1.0	1.0	1.4	1.4
6	2.6	4.7	2.6	1.6	1.0	1.0	1.4	1.5
7	2.7	4.5	2.8	1.6	1.0	1.0	1.5	1.5
8	2.7	4.2	2.8	1.6	1.0	1.0	1.4	1.5
9	2.6	4.0	2.6	1.6	1.0	1.0	1.4	1.5
10	2.9	3.8	2.4	1.5	.9	1.1	1.4	1.6
11	3.2	3.5	2.4	1.5	.9	1.2	1.4	1.9
12	3.7	3.2	2.4	1.4	.9	1.2	2.4	2.4
13	4.0	3.1	2.4	1.4	.9	1.2	1.4	2.5
14	4.2	3.0	2.5	1.4	.8	1.2	1.4	2.5
15	4.1	3.0	2.6	1.4	.8	1.3	1.4	2.5
16	4.1	2.8	2.5	1.4	.8	1.3	1.4	2.6
17	4.2	2.7	2.4	1.4	.9	1.3	1.4	2.6
18	4.3	2.6	2.4	1.4	.9	1.3	1.4	2.7
19	4.3	2.5	2.4	1.4	1.0	1.3	1.5	2.7
20	4.3	2.5	2.5	1.5	1.0	1.3	1.5	2.8
21	4.3	2.4	2.4	1.5	.9	1.3	1.4	2.8
22	4.2	2.5	2.4	1.4	.9	1.3	1.4	2.7
23	4.2	2.6	2.6	1.2	.9	1.3	1.5	2.6
24	4.2	3.0	2.5	1.2	.9	1.3	1.5	2.6
25	4.3	3.4	2.3	1.2	.9	1.3	1.5	2.6
26	4.3	3.5	2.2	1.2	.9	1.3	1.5	2.6
27	4.3	3.4	2.1	1.1	.9	1.4	1.5	2.7
28	4.3	3.4	2.1	1.1	1.0	1.4	1.4	2.9
29	4.2	3.4	2.1	1.0	1.0	1.4	1.4	3.1
30	4.3	3.2	2.0	1.1	1.0	1.4	1.4	3.1
31	.....	3.0	.....	1.1	1.0	.....	1.4	.....

NOTE.—No information available regarding the extent to which ice existed at this station during 1911.

Daily discharge, in second-feet, of Bog River near Tupper Lake, N. Y., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	180	1,260	455	166	37	28	60	72
2	186	1,540	455	166	37	28	60	72
3	186	1,540	375	148	28	28	60	72
4	208	1,470	375	131	28	28	60	72
5	254	1,470	375	115	28	28	72	72
6	310	1,400	310	100	28	28	72	85
7	340	1,260	375	100	28	28	85	85
8	340	1,060	375	100	28	28	72	85
9	310	940	310	100	28	28	72	85
10	415	825	254	85	20	37	72	100
11	535	670	254	85	20	48	72	148
12	770	535	254	72	20	48	72	254
13	940	495	254	72	20	48	72	280
14	1,060	455	280	72	14	48	72	280
15	1,000	455	310	72	14	60	72	280
16	1,000	375	280	72	14	60	72	310
17	1,060	340	254	72	20	60	72	310
18	1,130	310	254	72	20	60	72	340
19	1,130	280	254	72	28	60	85	340
20	1,130	280	280	85	28	60	85	375
21	1,130	254	254	85	20	60	72	375
22	1,060	280	254	72	20	60	72	340
23	1,060	310	310	48	20	60	85	310
24	1,060	455	280	48	20	60	85	310
25	1,130	625	230	48	20	60	85	310
26	1,130	670	208	48	20	60	85	310
27	1,130	625	186	37	20	72	85	340
28	1,130	625	186	37	28	72	72	415
29	1,060	625	186	28	28	72	72	495
30	1,130	535	166	37	28	72	72	495
31	.....	455	.....	37	28	.....	72	.....

NOTE.—Daily discharge determined from a discharge rating curve fairly well defined below about 80 second-feet. Discharge Apr. 1 estimated.

Monthly discharge of Bog River near Tupper Lake, N. Y., for 1911.

[Drainage area, 132 square miles.]

Month.	Discharge in second-feet.				Run-off d(epth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	120	0.909	1.05	D.
February	.....	.....	100	.758	.79	D.
March	.....	.....	120	.909	1.05	D.
April	1,130	180	783	5.93	6.62	A.
May	1,540	254	723	5.48	6.32	A.
June	455	166	286	2.17	2.42	A.
July	166	28	80.1	.607	.70	A.
August	37	14	23.9	.181	.21	C.
September	72	28	49.6	.376	.42	A.
October	85	60	73.8	.559	.64	A.
November	495	72	247	1.87	2.09	A.
December	.....	.....	450	3.41	3.93	D.
The year	1,540	14	255	1.93	26.24	

NOTE.—Discharge January, February, March, and December estimated from climatologic records and general conditions of run-off in northern New York.

ST. REGIS RIVER AT BRASHER CENTER, N. Y.

Location.—At the steel highway bridge in the village of Brasher Center, 5 miles downstream from Brasher Falls, 6¼ miles below the junction of East and West branches of St. Regis River, and about 12 miles above the mouth.

Records available.—August 22, 1910, to December 31, 1911. Data published also in annual reports of State Water Supply Commission and State Conservation Commission of New York.

Drainage area.—621 square miles (measured on post-route map).

Gage.—Chain, fastened to downstream side of bridge; read twice daily; datum unchanged.

Channel.—Very rough; composed of gravel and large bowlders; considered permanent. Velocity of current at high stages very swift and water rough.

Discharge measurements.—At low stages made by wading about 500 feet below the bridge; at high stages made from the bridge.

Winter flow.—Relation of gage height to discharge affected by ice.

Accuracy.—Discharge rating curve not yet developed.

Cooperation.—Established by United States Geological Survey in cooperation with the State Water Supply Commission of New York.

Discharge measurements of St. Regis River at Brasher Center, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 20[a]	Shuttleworth and Hoyt	7.15	526
Apr. 13	C. S. De Golyer	6.30	3,750
13	do	6.26	3,650
July 2	G. H. Canfield	4.57	709

[a] Measurement made under complete ice cover about 400 feet above gage. Gage height to top of ice 7.20 feet; average thickness of ice 0.85 foot.

Daily gage height, in feet, of St. Regis River at Brasher Center, N. Y., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.70	6.20	4.75	4.55	4.28	4.15	4.42	4.48	5.32
2	.....	5.55	6.68	4.72	4.52	4.25	4.05	4.45	4.72	5.32
3	.....	5.60	6.32	4.82	4.55	4.10	4.02	4.42	4.75	5.08
4	.....	5.40	6.20	4.80	4.62	4.08	4.05	4.60	4.59	4.95
5	.....	5.15	5.90	4.74	4.56	4.15	4.10	5.00	4.52	4.85
6	.....	8.25	5.80	4.80	4.48	4.22	4.15	5.20	4.51	4.71
7	.....	8.70	5.55	4.85	4.62	4.29	4.75	5.12	4.60	4.78
8	.....	8.80	5.50	4.65	4.45	4.28	4.78	4.95	4.90	4.72
9	.....	7.25	5.42	4.68	4.48	4.20	4.68	4.78	5.08	4.95
10	.....	6.60	5.35	4.90	4.41	4.32	4.45	4.68	5.06	5.10
11	.....	6.35	5.30	4.65	4.42	4.15	4.30	4.45	5.04	5.35
12	.....	6.20	5.30	4.80	4.45	4.05	4.38	4.40	5.04	5.52
13	.....	6.40	5.12	4.92	4.18	4.19	4.35	4.55	4.85	6.10
14	.....	6.70	5.05	5.12	4.15	4.12	4.38	4.48	4.84	6.08
15	.....	6.85	5.15	5.15	4.08	4.08	4.45	4.38	4.82	5.82
16	.....	6.80	4.55	5.25	4.15	4.15	4.38	4.36	4.76	5.72
17	.....	6.75	4.85	5.12	4.08	4.12	4.32	4.38	4.80	5.35
18	.....	6.65	4.68	4.95	4.32	4.09	4.28	4.45	4.90	5.28
19	.....	6.10	4.75	4.72	4.25	4.12	4.40	4.55	5.15	5.40
20	.....	6.25	4.55	4.60	4.35	4.25	4.40	4.06	5.09	5.32
21	.....	5.95	4.58	4.72	4.22	4.30	4.38	4.52	5.06	5.25
22	.....	6.15	4.65	4.82	4.19	4.25	4.25	4.52	5.04	5.18
23	.....	6.18	4.78	4.65	4.10	4.22	4.22	4.45	4.92	5.55
24	.....	6.02	4.70	4.52	4.08	4.22	4.25	4.48	4.49	5.60
25	.....	6.00	5.95	4.38	4.15	4.30	4.22	4.35	4.78	5.42
26	.....	6.18	5.55	4.38	4.05	4.21	4.35	4.45	4.72	5.38
27	.....	6.28	5.25	4.58	4.18	4.32	4.72	4.44	4.70	5.30
28	7.95	6.25	5.05	4.60	3.98	4.15	5.02	4.42	4.75	5.30
29	6.88	6.28	5.05	4.55	4.09	4.35	4.42	4.41	5.20	5.60
30	6.15	6.25	4.85	4.59	3.95	4.32	4.35	4.38	5.35	5.78
31	5.80	.....	4.75	.....	3.98	4.38	.....	4.48	.....	5.95

NOTE.—Relation of gage height to discharge probably affected by backwater from ice during the latter part of March, the first part of April, and the last few days of December. It is not known when the ice passed out of the river.

RICHELIEU RIVER AND LAKE CHAMPLAIN.

LAKE CHAMPLAIN AT BURLINGTON, VT.

Location.—On the south side of the roadway leading to the dock of the Champlain Transportation Co. at Burlington, Vt., at a point about 80 feet from the road at the foot of King Street.

Records available.—May, 1907, to December 31, 1911.

Gage.—Staff; read once daily. Comparison of gage readings, made under the direction of Prof. A. D. Butterfield on calm days during 1907–8, indicate that the zero of the gage at Burlington is at practically the same elevation as that of the gage at Fort Montgomery, namely, 92.50 feet above mean sea level.

Cooperation.—Gage heights at Burlington and tables showing dates when the ice went out and transportation began, furnished through the courtesy of Mr. D. A. Loomis, general manager of the Champlain Transportation Co.

Daily gage height, in feet, of Lake Champlain at Burlington, Vt., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					6.00	3.75	2.15		0.60		1.10	1.50
2					6.05	3.65		1.10	.60		1.10	1.50
3	1.50			2.94	6.25	3.55	2.10	1.10			1.10	
4				2.97	6.23			1.10	.60		1.00	1.50
5					6.15	3.48		1.10	.60		1.05	1.50
6				3.05	6.10	3.40	2.00		.60		1.10	1.50
7				3.38	5.95	3.30	1.95	1.05	.60	0.65	1.10	1.55
8				3.82		3.25					1.10	1.55
9	2.00				5.85	3.15	1.80	.85		.65	1.10	1.50
10				4.48	5.80	3.12		.85		.65	1.10	
11				4.64	5.70		1.80	.85		.68	1.05	1.55
12			[a] 2.10	4.75	5.55	3.05	1.70	.85	.65	.68		1.60
13			[a] 2.20	4.90	5.40	3.00	1.65			.70	1.10	1.70
14			[a] 2.10	5.05	5.25	2.95	1.60	.80	.55	.70	1.10	1.90
15			[a] 2.10	5.33		2.90	1.58	.80			1.10	2.10
16			1.70		5.12			.80	.52	.65	1.10	2.20
17	2.20		1.70	5.82	5.05		1.55	.78		.65	1.15	
18				5.90	4.95		1.51	.78	.56	.65	1.20	2.30
19				5.92	4.85		1.45	.78	.60	.75		2.30
20				5.93	4.80	2.75			.60	.85	1.22	2.30
21			1.80	5.94		2.68	1.40	.70	.58	.90	1.28	2.30
22				5.95	4.55	2.60	1.40	.70			1.30	2.30
23						2.55		.70		1.00	1.30	2.45
24		2.10		5.90	4.40	2.50	1.30	.65		1.05	1.30	
25				5.90	4.30		1.25	.64		1.05	1.30	2.50
26				5.89	4.20	2.40	1.20		.60	1.10		2.70
27			1.90	5.90	4.10	2.35	1.20	.60		1.10	1.30	2.90
28			2.15	5.95		2.30	1.20	.52	.57	1.10	1.35	2.90
29			2.40	5.95	4.00	2.25	1.15	.60			1.40	2.90
30					3.90	2.20		.60	.52	1.10	1.40	2.80
31			2.80		3.80		1.15	.60		1.15		

[a] To top of ice.

NOTE.—The lake was frozen at the gage during January, February, March, and April. The thickest ice recorded was 18½ inches Mar. 13 and 20. No ice notes for the latter part of the year.

RICHELIEU RIVER AT FORT MONTGOMERY, ROUSES POINT, N. Y.

Location.—About half a mile from the head of Richelieu River at the outlet of Lake Champlain, about 1 mile northeast of the village of Rouses Point and three-eighths of a mile south of the Canadian boundary; in the fort.

Records available.—1875 to 1911; data published in the reports of the Deep Waterways Survey, the annual reports of the State engineer and surveyor of the State of New York, and in the water-supply papers of the United States Geological Survey. Gage heights for 1911 will be published in the 1912 report.

Drainage area.—8,180 square miles at Chambly.

Gage.—Staff, read once daily. Elevation of gage zero at Fort Montgomery is 92.50 feet above mean sea level; high-water level is at elevation 101.6 feet; probably lowest elevation recorded at Fort Montgomery is 91.9 feet November 13, 1908.

Determination of flow.—The daily discharge of the lake has been determined from observations of depth and discharge over the Chambly dam, 35 miles below the head of Richelieu River, made in 1898 by the United States Board of Deep Waterways. A discharge rating curve has been constructed from the observations at Chambly dam and the gage readings at Rouses Point. The area tributary to the river between Rouses Point and Chambly is 310 square miles.

Winter flow.—Relation of gage height to discharge probably affected by ice, as the entire surface of Lake Champlain freezes over nearly every winter.

Cooperation.—Observations of gage heights are made under the direction of the Corps of Engineers of the United States Army. Gage readings reported weekly to the Survey through the courtesy of Maj. Edward Burr.

Accuracy.—Gage heights and estimates of daily discharge since 1907 are withheld pending verification of the rating curve.

AUSABLE RIVER AT AUSABLE FORKS, N. Y.

Location.—In the village of Ausable Forks, immediately below the junction of the East and West branches and about 15 miles above the mouth of the river.

Records available.—August 17, 1910, to December 31, 1911. Data also in annual reports of the New York State Water Supply Commission and New York State Conservation Commission.

Drainage area.—439 square miles (measured on post-route map).

Gage.—Chain, on the left bank, about 100 feet below the junction of East and West branches of Ausable River; read twice daily; datum unchanged.

Channel.—Sand and gravel; liable to shift. Divided by an island.

Discharge measurements.—Made from a car hung on a cable about 1½ miles below the gage. At this place the river flows in one channel.

Winter flow.—Ice may form on the riffles below the gage and either divert or cause backwater.

Accuracy.—Conditions at the measuring section good. Discharge rating curve not yet developed.

Cooperation.—Established by the United States Geological Survey in cooperation with the State Water Supply Commission of New York.

Discharge measurements of Ausable River at Ausable Forks, N. Y., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 25[a]	F. J. Shuttleworth	3.63	188
Apr. 14	C. S. De Golyer	4.96	2,130
14	do	4.97	2,160
June 28[b]	G. H. Canfield	3.73	308
Aug. 10[b]	do	3.54	152

[a] Measurement made by wading about 300 feet above gage. Section at cable frozen over. Average thickness, 1.2 feet. Section at gage nearly clear of ice.
[b] Measurements by wading at cable section.

Daily gage height, in feet, of Ausable River at Ausable Forks, N. Y., for 1911.

[H. Edward Minor, observer.]

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.82	3.90	5.7	3.87	3.69	3.52	3.61	3.64	3.70	3.98
2	.....	3.65	3.97	7.1	4.01	3.59	3.53	3.57	3.72	3.77	3.89
3	.....	3.92	3.99	5.15	3.87	3.67	3.53	3.57	3.68	3.78	3.76
4	.....	3.63	4.03	4.70	3.79	3.60	3.54	3.57	3.70	3.76	3.84
5	.....	3.65	3.84	4.35	3.81	3.58	3.50	3.58	4.35	3.63	3.78
6	.....	3.76	5.05	4.25	3.71	3.58	3.49	4.00	4.16	3.67	3.76
7	.....	3.88	5.9	4.30	3.77	3.60	3.56	4.18	3.94	3.77	3.70
8	.....	3.66	5.00	4.65	3.67	3.57	3.58	3.84	3.75	4.13	3.71
9	.....	3.65	4.27	4.80	3.88	3.53	3.60	3.63	3.78	4.00	3.75
10	.....	3.62	4.33	4.80	3.94	3.57	3.55	3.64	3.76	3.88	3.65
11	.....	3.63	4.29	4.65	3.91	3.56	3.56	3.62	3.76	3.88	3.99
12	.....	3.66	4.30	4.75	3.99	3.52	3.51	3.64	3.69	3.95	4.70
13	.....	3.92	4.48	4.55	4.52	3.56	3.52	3.66	3.64	4.43	5.7
14	.....	3.86	5.10	4.14	4.31	3.48	3.53	3.62	3.63	4.07	4.85
15	.....	3.90	5.6	4.09	4.17	3.48	3.52	3.62	3.64	3.91	4.44
16	.....	4.02	5.00	3.93	4.23	3.54	3.56	3.67	3.63	3.82	4.18
17	.....	3.98	4.60	4.47	4.15	3.56	3.52	3.61	3.58	3.80	4.15
18	.....	3.72	4.45	3.94	3.95	3.61	3.59	3.70	3.69	3.84	4.05
19	.....	3.64	4.28	4.09	3.83	3.70	3.48	3.62	4.36	3.86	3.88
20	.....	3.68	4.38	4.07	3.79	3.62	3.54	3.62	4.19	3.80	4.14
21	.....	3.73	4.34	3.91	3.76	3.56	3.66	3.56	4.05	3.78	3.99
22	.....	3.70	4.28	3.97	3.73	3.56	3.53	3.66	4.10	3.72	3.80
23	.....	3.82	4.28	3.92	3.71	3.49	3.56	3.62	4.20	3.68	4.56
24	.....	4.70	4.22	4.03	3.75	3.53	3.55	3.58	4.06	3.74	4.68
25	3.63	3.91	4.44	4.11	3.55	3.54	3.62	3.72	3.92	3.76	4.28
26	3.66	4.18	4.75	4.09	3.85	3.60	3.55	3.64	3.82	3.51	4.14
27	3.92	4.46	4.95	3.95	3.69	3.79	3.54	3.68	3.78	3.65	3.97
28	4.07	4.85	5.35	3.83	3.66	3.55	3.56	3.62	3.77	3.69	3.92
29	.....	4.36	5.55	3.83	.....	3.55	3.64	3.64	3.66	4.02	4.22
30	.....	4.14	5.55	3.72	.....	3.55	3.68	3.68	3.66	4.02	4.70
31	.....	3.98	.....	3.69	.....	3.60	3.63	.....	3.69	.....	4.70

NOTE.—The relation of gage height to discharge was known to be affected by ice Feb. 25. It is probable that there was also backwater effect from ice from Jan. 1 until some time in March.

EAST CREEK NEAR RUTLAND, VT.

Location.—At Lester Bridge, on the road from Rutland to Brandon, Vt., about 3 miles north of Rutland, 2½ miles below the union of the two branches which drain Blue Ridge Mountain, and 3½ miles above the confluence with Otter River.

Records available.—August 9 to December 31, 1911.

Drainage area.—47 square miles.

Gage.—Vertical staff fastened to the left-hand downstream side of the bridge.

Channel.—Probably permanent.

Discharge measurements.—Made from the bridge or by wading.

Artificial control.—The flow of the stream is regulated by two dams near the headwaters and one dam about a mile below the station. The upper dams store considerable water. The relation between gage heights and discharge is not affected by backwater from the dam below.

Accuracy.—Accurate computation of the diurnal fluctuation of discharge caused by the operation of the mills above the station has been rendered impossible by insufficient funds. It is proposed to install an automatic gage to determine the relation between the daily gage heights heretofore recorded and the true mean gage heights, thus making possible the publication of accurate computations of daily discharge from the inception of the station to date. The gage heights for 1911 are withheld pending this investigation, as no gage heights recorded at this station are true indices of the daily discharge.

Discharge measurements of East Creek near Rutland, Vt., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 7	G. H. Canfield	3.59	46.0
Aug. 16	do	3.69	57.2

[a] Wading 150 feet downstream from bridge.

WINOOSKI RIVER ABOVE STEVENS BRANCH, NEAR MONTPELIER, VT.

Location.—At the plant of the Corry-Deavitt & Frost Co., 3 miles above Montpelier, Vt., above the several large tributaries that enter in the vicinity of Montpelier.

Records available.—May 18, 1909, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff bolted to a bowlder on the right bank about 100 feet below the power plant; datum unchanged.

Channel.—Probably permanent.

Discharge measurements.—Made from the lower railroad bridge about half a mile below the gage.

Artificial control.—As the power plant is operated on a 24-hour schedule, daily fluctuations in the stage of the river are usually not great.

Winter flow.—Considerable effect by anchor ice.

Accuracy.—Accurate computation of the diurnal fluctuation of discharge caused by the operation of the mills above the station has been rendered impossible by insufficient funds. It is proposed to install an automatic gage to determine the relation between the daily gage heights heretofore recorded and the true mean gage heights, thus making possible the publication of accurate computations of daily discharge from the inception of the station to date. The gage heights for 1911 are withheld pending this investigation, as no gage heights recorded at this station are true indices of the daily discharge.

Cooperation.—Station established in cooperation with State of Vermont. Gage heights have been furnished by the Corry-Deavitt & Frost Electric Co.

Discharge measurements of Winooski River above Stevens Branch, near Montpelier, Vt., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 21 [a]	G. H. Canfield	2.64	136
21 [b]	do	2.19	43.6
Aug. 5 [b]	do	2.19	43.9
5 [c]	do	1.75	8.5
6	do	2.38	71.9

[a] One turbine at 0.8 gate opening; other turbine at full gate opening.
[b] Only one turbine running at 0.5 gate opening.
[c] Neither wheel in operation; discharge indicates amount of water passing through the plant when the turbines are not being used.

NOTE.—First measurement made at railroad bridge below; all others made in tailrace of power plant.

WINOOSKI RIVER AT MONTPELIER, VT.

Location.—At the covered wooden highway bridge near the Central Vermont Railroad station in Montpelier and near the plant of the Colton Manufacturing Co., just above the mouth of Dog River.

Records available.—May 19, 1909, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Chain, attached to the highway bridge; datum unchanged.

Channel.—Probably permanent.

Discharge measurements.—Made from a footbridge about half a mile below the highway bridge.

Winter flow.—Relation between gage heights and discharge during the winter months is sometimes affected by ice.

Accuracy.—Accurate computation of the diurnal fluctuation of discharge caused by the operation of the mills above the station has been rendered impossible by insufficient funds. It is proposed to install an automatic gage to determine the relation between the daily gage heights heretofore recorded and the true mean gage heights, thus making possible the publication of accurate computations of daily discharge from the inception of the station to date. The gage heights for 1911 are withheld pending this investigation, as no gage heights recorded at this station are true indices of the daily discharge.

Cooperation.—Station established in cooperation with the State of Vermont; gage readings furnished by the Colton Manufacturing Co.

Discharge measurements of Winooski River at Montpelier, Vt., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 20[a]	G. H. Canfield	4.18	200
Aug. 6[b]	do	3.65	17.1

[a] Made from suspension bridge one-half mile below gage.
[b] Made by wading 1 mile below gage.

WORCESTER BRANCH OF WINOOSKI RIVER AT MONTPELIER, VT.

Location.—At Montpelier, a short distance below the plant of the Lane Manufacturing Co., near the junction of Worcester Branch with the main stream.

Records available.—May 15, 1909, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff fastened to a stone wall and tree about 100 feet below the plant; datum unchanged.

Channel.—Probably permanent.

Discharge measurements.—Made from a steel highway bridge about 300 feet below the gage.

Winter flow.—Relation between gage height and discharge during the winter months is materially affected by ice.

Accuracy.—Accurate computation of the diurnal fluctuation of discharge caused by the operation of the mills above the station has been rendered impossible by insufficient funds. It is proposed to install an automatic gage to determine the relation between the daily gage heights heretofore recorded and the true mean gage heights, thus making possible the publication of accurate computations of daily discharge from the inception of the station to date. The gage heights for 1911 are withheld pending this investigation, as no gage heights recorded at this station are true indices of the daily discharge.

Cooperation.—Station established in cooperation with the State of Vermont. Gage readings furnished by the Lane Manufacturing Co.

Discharge measurements of Worcester Branch of Winooski River at Montpelier, Vt., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 20 [a]	G. H. Canfield	1.07	28.0
Aug. 6 [b]	do	.80	4.9

[a] Made from highway bridge about 500 feet below gage.
[b] Made by wading near the gage. Power plant not in operation; measurement indicates leakage through wheels.

DOG RIVER AT NORTHFIELD, VT.

Location.—At the wooden highway bridge about 600 feet below the dam of the Rabidou Lumber Co. and about three-fourths of a mile from the railroad station at Northfield, Vt.

Records available.—May 14, 1909, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff attached to the highway bridge; datum unchanged.

Channel.—Probably permanent.

Discharge measurements.—Made from the highway bridge to which the gage is fastened, and also from a highway bridge near Norwich University.

Winter flow.—Relation between gage height and discharge during the winter months seriously affected by ice.

Accuracy.—Accurate computation of the diurnal fluctuation of discharge caused by the operation of the mills above the station has been rendered impossible by insufficient funds. It is proposed to install an automatic gage to determine the relation between the daily gage heights heretofore recorded and the true mean gage heights, thus making possible the publication of accurate computations of daily discharge from the inception of the station to date. The gage heights for 1911 are withheld pending this investigation, as no gage heights recorded at this station are true indices of the daily discharge.

Cooperation.—Station established in cooperation with the State of Vermont. With the exception of the computations of results and a few discharge measurements, all of the data for this station have been collected by students of Norwich University under the direction of Prof. C. S. Carleton.

The following discharge measurement was made by G. H. Canfield by wading 100 feet above the bridge:

June 19, 1911: Gage height, 1.00 foot; discharge, 120 second-feet.

LAMOILLE RIVER AT JOHNSON, VT.

Location.—At the highway bridge in the town of Johnson on the main road from the railroad station to the post office about 400 feet above the mouth of Ginon River.

Records available.—July 14, 1910, to December 31, 1911; from July 28, 1909, to July 13, 1910, a station was maintained on the Lamoille at Morrisville.

Drainage area.—Not measured.

Gage.—Chain, fastened to the hand rail of the bridge.

Channel.—Probably permanent; bed composed of gravel; ledge rock projects from the left bank; a small gravel riffle about 350 feet below the bridge will prevent backwater at the gage.

Discharge measurements.—At high stages made from footbridge; at low stages made by wading about 500 feet above the bridge.

Accuracy.—Accurate computation of the diurnal fluctuation of discharge caused by the operation of the mills above the station has been rendered impossible by insufficient funds. It is proposed to install an automatic gage to determine the relation between the daily gage heights heretofore recorded and the two mean gage heights, thus making possible the publication of accurate computations of daily discharge from the inception of the station to date. The gage heights for 1911 are withheld pending this investigation, as no gage heights recorded at this station are true indices of the daily discharge.

Cooperation.—Station established and maintained in cooperation with the State of Vermont.

Discharge measurements of Lamoille River at Johnson, Vt., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 27	G. H. Canfield	2.12	104
Aug. 5[a]	do	2.09	95.8

[a] Made by wading 400 feet above the bridge.

MISSISQUOI RIVER NEAR RICHFORD, VT.

Location.—At the highway bridge 200 feet below the Central Vermont Railroad bridge, 3 miles downstream from Richford, about 3 miles below the mouth of North Branch, and 2 miles above the mouth of Trout River.

Records available.—May 29, 1909, to December 31, 1911.

Drainage area.—300 square miles.

Gage.—Chain fastened to the downstream side of the bridge; installed June 26, 1911. From May 29, 1909, to December 31, 1910, the gage was just below the plant of the Sweat, Comings Company; this site was found unsatisfactory because of the great daily fluctuations caused by the operation of the turbines.

Channel.—Deep; banks not liable to be overflowed; bed composed of gravel, bowlders, and rock ledge; current sluggish at low stages. A well-defined riffle about half a mile downstream protects the gage from backwater from the mills.

Discharge measurements.—At high stages made from downstream side of bridge; at low stages by wading.

Accuracy.—Accurate computation of the diurnal fluctuation of discharge caused by the operation of the mills above the station has been rendered impossible by insufficient funds. It is proposed to install an automatic gage to determine the relation between the daily gage heights heretofore recorded and the true mean gage heights, thus making possible the publication of accurate computations of daily discharge from the inception of the station to date. The gage heights for 1911 are withheld pending this investigation, as no gage heights recorded at this station are true indices of the daily discharge.

Cooperation.—Station established in cooperation with the State of Vermont.

Discharge measurements of Missisquoi River near Richford, Vt., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 26	G. H. Canfield	5.10	188
Aug. 4[a]	do	4.74	82.2

[a] Measurement made by wading ¼ mile above the gage.

TRIBUTARY THROUGH ST. FRANCIS RIVER.

CLYDE RIVER AT WEST DERBY, VT.

Location.—Just below the plant of the Newport Electric Light Co., at West Derby, Vt.

Records avaliable.—May 25, 1909, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff, in two sections; low section about 75 feet below the plant; high-water section nailed to a tree on the right bank 10 feet farther downstream; datum unchanged.

Channel.—Bed rough; fall of river rapid near and below the station.

Discharge measurements.—Made from highway bridge about half a mile below the gage.

Artificial control.—At West Derby are two dams both operated under the same management; at the upper dam part of the water is used by a paper mill and the remainder is delivered to the water wheels at the electric plant through a steel penstock; the total operating head from this dam is about 108 feet. All the flow from the second dam is diverted to the wheels in the power house, giving a head of about 30 feet. Practically no water is stored at the upper dam, but a pond of considerable size may be made by building a dam above this point.

Accuracy.—Accurate computation of the diurnal fluctuation of discharge caused by the operation of the mills above the station has been rendered impossible by insufficient funds. It is proposed to install an automatic gage to determine the relation bteween the daily gage heights heretofore recorded and the true mean gage heights, thus making possible the publication of accurate computations of daily discharge from the inception of the station to date. The gage heights for 1911 are withheld pending this investigation, as no gage heights recorded at this station are true indices of the daily discharge.

Cooperation.—Station established in cooperation with the State of Vermont. Gage heights furnished by the Newport Electric Light Co.

Discharge measurements of Clyde River at West Derby, Vt., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 24	G. H. Canfield	2.17	125
25	do	2.13	117
Aug. 3	do	1.90	78.4
3[a]	C. C. Covert	1.92	82
3[b]	do	1.88	71.9
Oct. 27	do	2.26	165

[a] Water backed up by mill, 300 feet below bridge.
[b] Made by wading above bridge.

MISCELLANEOUS DISCHARGE MEASUREMENTS IN ST. LAWRENCE RIVER BASIN.

The following miscellaneous discharge measurements were made in the St. Lawrence River basin in 1911:

Miscellaneous measurements in St. Lawrence River drainage basin in 1911.

Date.	Stream.	Tributary to	Locality.	Discharge.
				Sec.-ft.
June 4	Pigeon River	Lake Superior	6 miles above Cascades, Minn.	107
May 29	Arrow River	Pigeon River	½ mile above mouth	284
July 9	Temperance River	Lake Superior	600 feet above highway bridge near Schroeder, Minn.	35
Aug. 4	do	do	do	196
Oct. 6	do	do	do	189
July 13	Cross River	do	Near mouth near Schroeder, Minn.	*a* 7.6
Aug. 1	do	do	do	90
Oct. 6	do	do	do	66
May 7	Manitou River	do	At mouth, Minn	119
Aug. 5	do	do	do	147
Oct. 6	do	do	do	121
Apr. 23	Silver Creek	do	2 miles above mouth	16
May 8	Baptism River	do	At mouth, Minn	135
July 22	do	do	do	19
Aug. 5	do	do	do	272
Oct. 7	do	do	do	139
July 29	Gooseberry River	do	do	27
Aug. 6	do	do	do	15
Apr. 25	do	do	do	49
May 9	Lester River	do	do	16

Date.	Stream.	Tributary to—	Locality.	Gage height.[b]	Discharge.
				Feet.	*Sec.-ft.*
Mar. 15	Canaseraga Creek	Genesee River	Shakers Crossing, N. Y.	14.35	*c* 1,500
30	do	do	do	17.84	1,180
26	do	do	do	21.15	*d* 242
Aug. 26	Tailrace, Mount Morris power plant.	do	50 feet above the bridge, Mount Morris, N. Y.	*e* 2.52	179
May 20	Salmon River	Lake Ontario	Highway bridge 1½ miles west of Redfield, N. Y.	*f* 11.64	413
Aug. 10	Palmer Creek	Ausable River	Near bridge between Miners Hotel and railroad station, Ausable Forks, N. Y.		.8
Aug. 8	Cold River	Otter Creek	Railroad bridge near Rutland, Vt.		*g* 7.8

a Logging dams closed.
b Distance from reference point to water surface.
c About 300 second-feet from Genesee River on account of diversion for power. Some indication of back water from Genesee River.
d Measurement of diversion from Genesee River in tailrace gave 179 second-feet.
e Gage at highway bridge below mills.
f Reference point, top of crossbeam upstream side, 45 feet from right abutment.
g Does not represent total discharge. There is a diversion through an old power canal about 1 mile above point of measurement. This condition ascertained from a local engineer after measurement was made.

SUMMARY OF DISCHARGE PER SQUARE MILE.

The following summary of discharge per square mile is given to allow ready comparison of relative rates of run-off from different areas in the St. Lawrence River drainage basin. It shows in a general way the seasonal distribution of run-off and the effect of snow, ground, surface, and artificial storage. But the most important fact worth noting is the almost entire lack of uniformity of agreement between any two stations. It indicates that the discharge of each stream is a law unto itself, and that all projects dependent upon stream flow, if they are to be developed along the safest and most economical lines, must be based on records of stream flow collected with great care over a long series of years as near the location of the project under consideration as possible:

Summary of discharge, in second-feet per square mile, for river stations in the St. Lawrence River drainage basin in 1911.

	Drainage area.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	Sq. m.													
St. Louis River near Thomson, Minn.	3,420	0.08	0.09	0.25	1.15	1.30	0.81	0.31	1.04	1.29	0.56	0.24	0.17	0.61
Whiteface River at Meadowlands, Minn.	442	....	....	....	....	1.74	1.40	.45	1.57	1.62	.70	....	....	....
Cloquet River near Independence, Minn.	698	.13	.14	.19	1.15	2.11	1.20	.47	.58	1.37	.88	.36	.07	.72
Escanaba River near Escanaba, Mich.	800	.34	.38	.62	3.25	2.16	1.03	.91	2.51	.91	1.84	1.44	1.25	1.39
Menominee River near Iron Mountain, Mich.	2,420	.35	.41	.62	1.60	2.04	.90	.70	1.48	.77	1.41	.95	1.06	1.03
Wolf River at Keshena, Wis.	797	.44	.50	.63	.94	1.01	.99	.64	.67	.85	1.84	1.91	1.25	.98
Manistee River near Sherman, Mich.	900	1.16	1.11	1.39	1.86	1.84	1.41	1.07	1.01	1.02	1.42	1.48	1.58	1.37
Huron River at Geddes, Mich.	757	.44	.82	.56	.74	.35	.22	.11	.11	.16	.43	.59	.63	.42
Huron River at Flat Rock, Mich.	1,000	.62	1.05	.53	.70	.37	.28	.16	.14	.16	.45	.64	.67	.48
Genesee River at St. Helena, N. Y.	1,030	2.67	1.52	2.67	2.59	.71	.64	.14	.48	.61	.99	1.41	1.78	1.35
Genesee River at Jones Bridge, near Mount Morris, N. Y.	1,410	2.48	1.56	2.80	2.21	.64	.45	.13	.41	.54	.76	1.10	1.52	1.21
Genesee River at Rochester, N. Y.	2,360	2.17	1.61	2.67	2.17	.61	.46	.19	.25	.38	.60	.87	1.30	1.11
Canadice Lake outlet near Hemlock, N. Y.	12.6	.39	.44	.78	.84	.32	.33	.31	.29	.29	.30	.33	.34	.41
Salmon River at Stillwater Bridge, near Redfield, N. Y.	191	....	....	....	....	....	....	.80	.58	1.24	2.74	4.40	6.49	....
Salmon River at Pulaski, N. Y.	264	....	....	....	12.8	3.30	2.47	.86	.50	1.23	2.20	3.83	5.80	....
Orwell Brook near Altmar, N. Y.	22.1	....	....	....	....	....	....	.76	.36	.84	1.29	3.01	4.05	....
Black River at Boonville, N. Y.	279	1.34	.99	2.18	8.28	3.91	2.05	.23	.28	.60	1.29	2.84	4.70	2.39
Black River at Felts Mills, N. Y.	1,851	1.44	.99	1.52	6.26	3.21	1.60	.45	.58	.72	1.12	2.22	3.81	1.99
Moose River at Moose River, N. Y.	346	1.73	1.16	2.02	7.60	4.80	1.71	.93	.58	.70	2.26	2.73	4.83	2.59
Oswegatchie near Ogdensburg, N. Y.	1,580	2.97	1.15	2.25	6.22	2.20	1.36	.55	.24	.52	.72	1.69	3.41	1.85
Raquette River at Raquette Falls, near Coreys, N. Y.	418	.89	.82	.74	3.97	7.11	2.97	.65	.24	.52	1.07	1.57	3.09	1.97
Raquette River at Piercefield, N. Y.	723	.81	.99	.75	2.81	5.71	2.22	.75	.40	.49	.42	1.09	2.61	1.59
Raquette River at Massena Springs, N. Y.	1,170	1.20	1.03	1.15	4.10	4.99	2.15	.75	.37	.45	.63	1.17	2.69	1.73
Bog River at Tupper Lake, N. Y.	132	.91	.76	.91	5.93	5.48	2.17	.61	.18	.38	.56	1.87	3.41	1.93

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DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPER 305

SURFACE WATER SUPPLY OF THE UNITED STATES

1911

PART V. HUDSON BAY AND UPPER MISSISSIPPI RIVER

PREPARED UNDER THE DIRECTION OF M. O. LEIGHTON

BY

ROBERT FOLLANSBEE, A. H. HORTON
AND H. J. JACKSON

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SURFACE WATER SUPPLY OF HUDSON BAY AND UPPER MISSISSIPPI RIVER, 1911.

By Robert Follansbee, A. H. Horton, and H. J. Jackson.

AUTHORITY FOR INVESTIGATIONS.

This volume is Part V of a series of 12 reports presenting results of measurements of flow made on certain streams in the United States during the calendar year 1911. The reports are listed below:

Papers on surface water supply of the United States, 1911.

Part.[a]	No.	Title.	Part.[a]	No.	Title.
I	301	North Atlantic coast.	VI	306	Missouri River basin.
II	302	South Atlantic coast and eastern Gulf of Mexico.	VII	307	Lower Mississippi River basin.
III	303	Ohio River basin.	VIII	308	Western Gulf of Mexico.
IV	304	St. Lawrence River basin.	IX	309	Colorado River basin.
V	305	Upper Mississippi River and Hudson Bay basins.	X	310	Great Basin.
			XI	311	Pacific coast in California.
			XII	312	North Pacific coast.

[a] For the purpose of uniformity in the presentation of reports, a general plan has been agreed upon by the United States Reclamation Service, the United States Forest Service, the United States Weather Bureau, and the United States Geological Survey, according to which the area of the United States has been divided into 12 parts, whose boundaries coincide with natural drainage lines indicated by the parts of the report.

The data presented in these reports were collected by the United States Geological Survey under authority implied in the organic law (20 Stat. L., p. 394), which contains the following paragraph:

Provided, That this officer [the Director] shall have the direction of the geological survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

The work was begun in 1888 in connection with special studies of water supply for irrigation. Since the fiscal year ending June 30, 1895, successive sundry civil bills passed by Congress have carried the following item and appropriations:

For gaging the streams and determining the water supply of the United States, and for the investigation of underground currents and artesian wells, and for the preparation of reports upon the best methods of utilizing the water resources.

Annual appropriations for the fiscal year ending June 30—

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911 to 1913, inclusive	150,000

In the execution of the work various private and State organizations have cooperated. Acknowledgments for such cooperation are made on page 15, and also in connection with the description of each station affected by the cooperative work.

PUBLICATIONS.

Measurements of stream flow have been made at more than 2,000 points in the United States and also at many points in small areas in Seward Peninsula and the Yukon-Tanana region, Alaska, and in the Hawaiian Islands. During 1911 gaging stations were maintained by the Survey and the cooperating organizations at about 1,500 points in the United States, and many discharge measurements were made at other points. In connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country, and will be made available in the regular surface water-supply papers from time to time. A complete list of the gaging stations maintained by the Survey to and including 1910 and a list of the papers relating to the water supply of the country has been published by the Survey as Water-Supply Paper 280. An index to the reports containing stream-flow measurements prior to 1904 has been published as Water-Supply Paper 119.

For each calendar year there has been prepared a report embodying the stream-flow data collected during that year, which has been published either as a part of the annual report of the Director, as a bulletin, or as a water-supply paper, as shown by the following table:

Stream-flow data in reports of the United States Geological Survey.

[A=Annual Report; B=Bulletin; WS=Water-Supply Paper.]

Report.	Character of data.	Year.
10th A, pt. 2	Descriptive information only	
11th A, pt. 2	Monthly discharge	1884 to Sept., 1890.
12th A, pt. 2	do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
WS 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
WS 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
WS 16	Descriptions, meaurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
WS 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
WS 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.

Stream-flow data in reports of the United States Geological Survey—Continued.

Report.	Character of data.	Year.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
WS 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
WS 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A, pt. 4	Monthly discharge	1900.
WS 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
WS 75	Monthly discharge	1901.
WS 82 to 85	Complete data	1902.
WS 97 to 100	do	1903.
WS 124 to 135	do	1904.
WS 165 to 178	do	1905.
WS 201 to 214	Complete data, except descriptions	1906.
WS 241 to 252	Complete data	1907–8.
WS 261 to 272	do	1909.
WS 281 to 292	do	1910.
WS 301 to 312	do	1911.

NOTE.—No data regarding stream flow are given in the 15th and 17th annual reports.

The table which follows gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1911. The data for any particular station will be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Me., 1903 to 1911, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, and 301, which contain records for the New England streams from 1903 to 1911.

Numbers of water-supply papers containing results of stream measurements, 1899–1911.

	1899 [a]	1900 [b]	1901	1902	1903	1904
North Atlantic coast (St. John River to York River)	35	47, [c] 48	65, 75	82	97	[d] 124, [e] 125, [f] 126
South Atlantic coast and eastern Gulf of Mexico (James River to the Mississippi)	[g] 35, 36	48	65, 75	[g] 72, 83	[g] 97, 98	[f] 126, 127
Ohio River basin	36	48, [h] 49	65, 75	83	98	128
St. Lawrence River and Great Lakes	36	49	65, 75	[i] 82, 83	97	129
Hudson Bay and upper Mississippi River	36	49	[j] 65, 66, 75	[j] 83, 85	[j] 98, 99, 100	[j] 128, 130
Missouri River	[k] 36, 37	49, [l] 50	66, 75	84	99	130, [m] 131
Lower Mississippi River	37	50	[j] 65, 66, 75	[j] 83, 84	[j] 98, 99	[j] 128, 131
Western Gulf of Mexico	37	50	66, 75	84	99	132
Colorado River	[n] 37, 38	50	66, 75	85	100	133
Great Basin	38, [p] 39	51	66, 75	85	100	133, [q] 134
Pacific coast in California	38, [r] 39	51	66, 75	85	100	134
North Pacific coast	38	51	66, 75	85	100	135

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39.
[b] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52.
[c] Wissahickon and Schuylkill rivers to James River.
[d] New England rivers only.
[e] Hudson River to Delaware River, inclusive.
[f] Susquehanna River to Yadkin River, inclusive.
[g] James River only.
[h] Scioto River.
[i] Lake Ontario and tributaries to St. Lawrence River proper.
[j] Tributaries of Mississippi from east.
[k] Gallatin River.
[l] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.
[m] Platte and Kansas rivers.
[n] Green and Gunnison rivers and Grand River above junction with Gunnison.
[o] Below junction with Gila.
[p] Mohave River only.
[q] Great Basin in California, excepting Truckee and Carson drainage basins.
[r] Kings and Kern rivers and south Pacific coast drainage basins.

Numbers of water-supply papers containing results of stream measurements, 1899–1911—Continued.

	1905	1906	1907–8	1909	1910	1911
North Atlantic coast (St. John River to York River)	[a] 165, [b] 166, [c] 167	[a] 201, [b] 202, [c] 203	241	261	281	301
South Atlantic coast and eastern Gulf of Mexico (James River to the Mississippi)	[c] 167, 168	[c] 203, 204	242	262	282	302
Ohio River basin	169	205	243	263	283	303
St. Lawrence River and Great Lakes	170	206	244	264	284	304
Hudson Bay and upper Mississippi River	171	207	245	265	285	305
Missouri River	172	208	246	266	286	306
Lower Mississippi River	[d] 169, 173	[d] 205, 209	247	267	287	307
Western Gulf of Mexico	174	210	248	268	288	308
Colorado River	175, [e] 177	211	249	269	289	309
Great Basin	176, [f] 177	212, [f] 213	250, [f] 251	270, [f] 271	290	310
Pacific coast in California	177	213	251	271	291	311
North Pacific coast	[g] 177, 178	214	252	272	292	312

[a] New England rivers only.
[b] Hudson River to Delaware River, inclusive.
[c] Susquehanna River to Yadkin River inclusive.
[d] Tributaries of Mississippi from east.
[e] Below junction with Gila.
[f] Great Basin in California, excepting Truckee and Carson drainage basin.
[g] Rogue, Umpqua, and Siletz rivers only.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and discharge in second-feet per square mile; and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. The units used in this series of reports are second-feet, second-feet per square mile, run-off depth in inches, and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the unit for the rate of discharge of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the following table of equivalents.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off depth in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

An "acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation work.

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:

Table for converting discharge in second feet per square mile into run-off in depth in inches over the area.

Discharge (second-feet per square mile).	Run-off (depth in inches).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.03719	1.041	1.079	1.116	1.153
2	.07438	2.083	2.157	2.231	2.306
3	.11157	3.124	3.236	3.347	3.459
4	.14876	4.165	4.314	4.463	4.612
5	.18595	5.207	5.393	5.578	5.764
6	.22314	6.248	6.471	6.694	6.917
7	.26033	7.289	7.550	7.810	8.070
8	.29752	8.331	8.628	8.926	9.223
9	.33471	9.372	9.707	10.041	10.376

NOTE.—For partial month multiply the values for one day by the number of days.

Table for converting discharge in second-feet into run-off in acre-feet.

Discharge (second-feet).	Run-off (acre-feet).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	1.983	55.54	57.52	59.50	61.49
2	3.967	111.1	115.0	119.0	123.0
3	5.950	166.6	172.6	178.5	184.5
4	7.934	222.1	230.1	238.0	246.0
5	9.917	277.7	287.6	297.5	307.4
6	11.90	333.2	345.1	357.0	368.9
7	13.88	388.8	402.6	416.5	430.4
8	15.87	444.3	460.2	476.0	491.9
9	17.85	499.8	517.7	535.5	553.4

NOTE.—For partial month multiply the values for one day by the number of days.

1 second-foot equals 40 California miner's inches (law of Mar. 23, 1901).

1 second-foot equals 38.4 Colorado miner's inches.

1 second-foot equals 40 Arizona miner's inches.

1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,317 gallons for one day.

1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.

1 second-foot for one year equals 31,536,000 cubic feet.

1 second-foot equals about 1 acre-inch per hour.

1 second-foot for one day equals 86,400 cubic feet.

1,000,000,000 (1 United States billion) cubic feet equals 11,570 second-feet for one day.

1,000,000,000 cubic feet equals 414 second-feet for one 28-day month.

1,000,000,000 cubic feet equals 399 second-feet for one 29-day month.

1,000,000,000 cubic feet equals 386 second-feet for one 30-day month.

1,000,000,000 cubic feet equals 373 second-feet for one 31-day month.

100 California miner's inches equals 18.7 United States gallons per second.

100 California miner's inches for one day equals 4.96 acre-feet.

100 Colorado miner's inches equals 2.60 second-feet.

100 Colorado miner's inches equals 19.5 United States gallons per second.
100 Colorado miner's inches for one day equals 5.17 acre-feet.
100 United States gallons per minute equals 0.223 second-feet.
100 United States gallons per minute for one day equals 0.442 acre-foot.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1½ horsepower equals about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel realizing 80 per cent of theoretical power.

EXPLANATION OF DATA.

For each regular current-meter gaging station the following data, so far as available, are given: Description of the station, list of discharge measurements, table of daily gage heights, table of daily discharges, table of monthly and yearly discharges and run-off. For stations located at weirs or dams the gage-height table is omitted.

In addition to statements regarding the location and installation of current-meter stations, the descriptions give information in regard to any conditions which may affect the constancy of the relation of gage height to discharge, covering such points as ice, logging, shifting channels, and backwater; also information regarding diversions which decrease the total flow at the measuring section. Statements are also made regarding the accuracy and reliability of the data.

The table of daily gage heights records the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day, usually in the morning and in the evening. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. All gage heights affected by the presence of ice in the streams or by backwater from obstructions are published as recorded, with suitable footnotes. The rating

MAP OF UNITED STATES, SHOWING MEAN ANNUAL PRECIPITATION

Blue lines and figures indicate average annual precipitation in depth in inches

Prepared by Henry Gannett mainly from data of the United States Geological Survey, and United States Weather Bureau

MAP OF UNITED STATES, SHOWING MEAN ANNUAL RUN-OFF

Blue lines and figures indicate average annual run-off in depth in inches

table is not applicable for such periods unless the proper corrections to the gage heights are known and applied. Attention is called to the fact that the zero of the gage is placed at an arbitrary datum and has no relation to zero flow or the bottom of the river. In general, the zero is located somewhat below the lowest known flow, so that negative readings shall not occur.

The discharge measurements and gage heights are the base data from which rating tables, daily discharge tables, and monthly discharge tables are computed.

The rating table gives, either directly or by interpolation, the discharge in second-feet corresponding to every stage of the river recorded during the period for which it is applicable. It is not published in this report but can be determined from the tables of daily gage heights and daily discharge, as follows:

First plot the discharge measurements for the current and earlier years on cross-section paper, with gage heights in feet as ordinates and discharge in second-feet as abscissas. Then tabulate a number of gage heights taken from the daily gage-height table for the complete range of stage given and the corresponding discharges for the days selected from the daily discharge table and plot the values on cross-section paper. The last points plotted will define the rating curve used and will lie among the plotted discharge measurements. After drawing the rating curve, a table can be developed by scaling off the discharge in second-feet for each tenth foot of gage height. These values should be so adjusted that the first differences shall always be increasing or constant, except for known backwater periods.

The table of daily discharges gives the discharges in second-feet corresponding to the observed gage heights as determined from the rating tables.

In the table of monthly discharge the column headed "Maximum" gives the mean flow, as determined from the rating table, for the day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise in the column at "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this the computations for the remaining columns, which are defined on page 10, are based.

The field methods used in the collection of the data presented in this series of reports are described in the introductory sections of Water-Supply Papers 261 to 272, inclusive, "Surface water supply of the United States, 1909." Plates I and II show the average precip-

itation and run-off in the United States as determined from the measurements of stream flow made by the Geological Survey and records of rainfall collected by the Weather Bureau; Plate III shows typical gaging stations indicating the method of suspending the current meter; Plate IV shows current meters[1] used in the work.

ACCURACY AND RELIABILITY OF FIELD DATA AND COMPARATIVE RESULTS.

The accuracy of stream-flow data depends primarily on the natural conditions at the gaging station and on the methods and care with which the data are collected. Errors of the first group depend on the degree of permanency of channel and of permanency of the relation between discharge and stage.

Errors of the second class are due, first, to errors in observation of stage; second, to errors in measurements of flow; and, third, to errors due to misinterpretation of stage and flow data.

In order to give engineers and others information regarding the probable accuracy of the computed results, footnotes are added to the daily discharge tables, stating the probable accuracy of the rating tables used, and an accuracy column is inserted in the monthly discharge table. For the rating tables "well defined" indicates, in general, that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined" or "approximate" within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The accuracy column in the monthly discharge table does not apply to the maximum or minimum nor to any individual day, but to the monthly mean. It is based on the accuracy of the rating, the probable reliability of the observer, and knowledge of local conditions. In this column, A indicates that the mean monthly flow is probably accurate within 5 per cent; B, within 10 per cent; C, within 15 per cent; D, within 25 per cent. Special conditions are covered by footnotes.

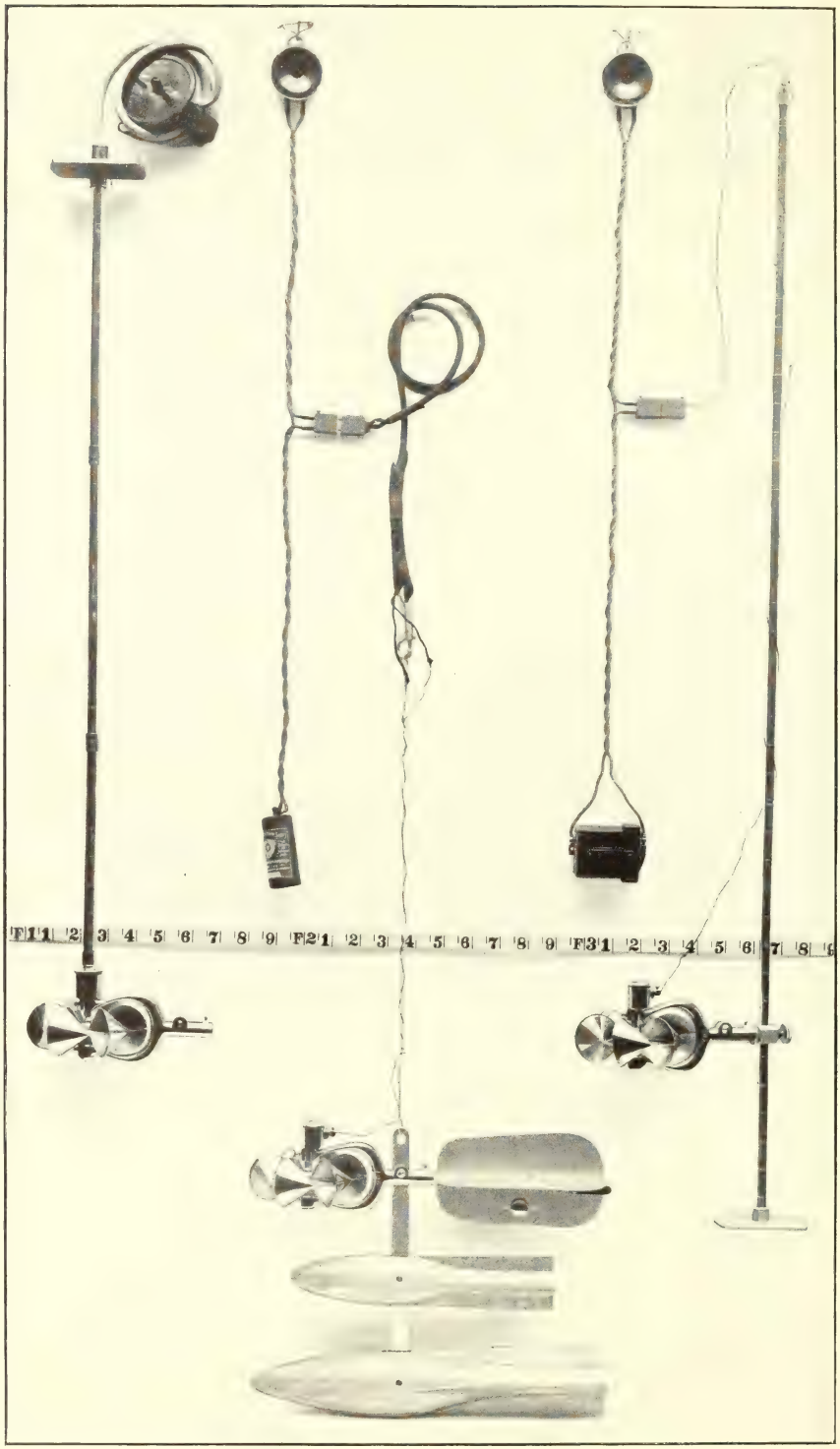
Even though the monthly means for any station may represent with a high degree of accuracy the quantity of water flowing past the gage, the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors which result from including in the measured drainage area large noncontributing districts or omitting estimates of water diverted for irrigation or other use, and they should, therefore, be considered as only approximate, particularly for periods of irrigation or of low water. For these errors it is as a rule not feasible to make adequate correction.

[1] See Hoyt, J. C., and others, Use and care of current meter as practiced by the United States Geological Survey: Trans. Am. Soc. Civil Eng., vol. 66, 1910, p. 70.

A. FOR BRIDGE MEASUREMENT.

B. FOR WADING MEASUREMENT.

TYPICAL GAGING STATIONS.



SMALL PRICE CURRENT METERS.

In general, the base data collected each year by the Survey engineers are published, not only to comply with the law, but also to afford any engineer the means of examining and adjusting to his own needs the results of the computations. The table of monthly discharge is so arranged as to give only a general idea of the flow at the station and should not be used for other than preliminary estimates. The determinations of daily discharge allow more detailed studies of the variation in flow by which the period of deficiency may be determined.

It should be borne in mind that the observations in each succeeding year may be expected to throw new light on data already collected and published, and the engineer who makes use of the figures presented in these papers should verify all ratings and make such adjustments for earlier years as may seem necessary.

COOPERATION AND ACKNOWLEDGMENTS.

Assistance has been rendered or records furnished by the following, to whom special acknowledgments are due:

United States Engineer Corps, for records of flow from reservoirs in the Upper Mississippi Basin.

United States Reclamation Service, for maintenance of stations in the St. Mary Basin,

United States Weather Bureau, for records of gage heights at St. Paul, Mankato, Chippewa Falls, Cedar Rapids, and other points.

Minnesota & Ontario Power Co., and Canadian Department of Public Works, for cooperation in the maintenance of the station at International Falls.

St. Anthony Falls Water Power Co., for records of the Mississippi at Minneapolis.

Minneapolis General Electric Co., for records of flow of the St. Croix River near St. Croix Falls, Wis.

Kettle River Co., for cooperation in the maintenance of the Sandstone station.

Wisconsin Valley Improvement Co., for gage-height records at Rhinelander, Merrill, and Necedah.

Chippewa Valley Railway Light & Power Co., for gage-height records of Red Cedar River at Chippewa Falls, Wis.

Chippewa Lumber & Boom Co., for records of gage heights at Chippewa Falls, Wis.

Mr. F. Dearborn, for gage records at Stone City, Iowa.

Iowa State Geological Survey, G. F. Kay, director, for cooperation in the maintenance of gaging stations at Cedar Rapids, Fort Dodge, Keosauqua, and Iowa Falls.

East Side Levee and Sanitary District of East St. Louis, Ill., for records on Cahokia Creek.

Work in Minnesota during 1911 has been done with State cooperation under the terms of an act of the legislature in 1909 as embodied in joint resolution 19, which reads as follows:

Whereas the water supplies, water powers, navigation of our rivers, drainage of our lands, and the sanitary condition of our streams and their watersheds generally form one great asset and present one great problem: Therefore, be it resolved by the house of representatives, the senate concurring, that the State Drainage Commission be and is hereby directed to investigate progress in other States toward the solution of said problem in such States, to investigate and determine the nature of said problem in this State.

The work has been carried on in conjunction with the State Drainage Commission, George A. Ralph, chief engineer.

The State of Illinois cooperates in stream-gaging work in that State, the appropriation being under the control of the Internal Improvement Commission, Isham Randolph, chairman, and, when that commission expired, of the Rivers and Lakes Commission, Robert R. McCormick, chairman.

DIVISION OF WORK.

The field data for the Hudson Bay drainage basin, except in Montana, were collected under the direction of Robert Follansbee, district engineer, St. Paul, Minn., from January 1 to November 1, and by W. G. Hoyt, district engineer, St. Paul, Minn., after November 1, assisted by E. F. Chandler, S. B. Soulé, and C. R. Adams, and in Montana under the direction of W. A. Lamb, district engineer, Helena, Mont., assisted by E. F. Chandler, B. E. Jones, George Ebner, and Goric Monley.

The field data for the upper Mississippi drainage basin, except in Illinois, were collected under the direction of Robert Follansbee, district engineer, St. Paul, Minn., from January 1 to November 1, inclusive, and by W. G. Hoyt, district engineer, St. Paul, Minn., after November 1, assisted by S. B. Soulé, C. J. Emerson, and C. R. Adams, and in Illinois under the direction of A. H. Horton, district engineer, Newport, Ky., assisted by C. T. Bailey and P. S. Monk.

The ratings, special estimates, and studies of the completed data were made by Robert Follansbee, A. H. Horton, R. H. Bolster, W. A. Lamb, W. G. Hoyt, H. J. Jackson, and E. F. Chandler.

The completed data were prepared for publication under the direction of R. H. Bolster, hydraulic engineer, by Robert Follansbee, and H. J. Jackson.

The computations were made under the direction of Robert Follansbee, R. H. Bolster, and H. J. Jackson, by H. D. Padgett, A. H. Tuttle, H. J. Dean, G. K. Larrison, O. De Carre, A. McMillan, C. L. Batchelder, W. R. King, and M. I. Walters.

The report was edited by Mrs. B. D. Wood.

HUDSON BAY DRAINAGE AREA IN THE UNITED STATES.

ST. MARY RIVER BASIN.

ST. MARY RIVER NEAR BABB, MONT.

Location.—Near dam site 1 mile below the outlet of Lower St. Mary Lake and 1 mile above the mouth of Swiftcurrent Creek.

Records available.—April 9, 1902, to December 31, 1911. The records for this station were published in Water Supply Papers Nos. 85 and 100 as "St. Mary River dam site," and in Water Supply Paper No. 130 as "St. Mary River at St. Mary."

Drainage area.—177 square miles.

Gage.—Chain gage on the right bank of the stream; datum unchanged since establishment.

Channel.—Practically permanent.

Discharge measurements.—Made from cable 300 feet below the gage. In September, 1909, the cable was moved from a point 300 feet farther downstream. Low-water measurements are made by wading one-fourth mile above the gage.

Floods.—The flood of June 5, 1908, reached a stage of about 9.4 feet.

Discharge measurements of St. Mary River near Babb, Mont., 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 14	W. A. Lamb	0.93	[a] 79
May 3	B. E. Jones	2.25	515
7	do	2.80	797
June 5	do	4.22	1,840
23	W. A. Lamb	4.52	2,140
July 17	do	3.03	990
Aug. 25	B. E. Jones	2.06	443
Oct. 12	do	1.82	332
Dec. 8	do	1.00	[b] 86

[a] Some ice at gage. Gage height taken with level; measurement made by wading.
[b] Measurement made from bridge at United States Reclamation Service camp.

Daily gage height, in feet, of St. Mary River near Babb, Mont., for 1911.

[Carl Giruin, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.55	1.35	1.05	0.95	2.2	2.8	3.8	2.55	1.9	2.3	1.35	1.0
2	.65	1.35	1.05	.95	2.2	3.3	3.7	2.5	1.9	2.25	1.35	1.0
3	.85	1.25	1.05	1.05	2.2	3.4	3.4	2.5	1.9	2.25	1.3	1.0
4	.75	1.25	.95	1.05	2.3	4.0	3.5	2.4	2.2	2.2	1.3	1.0
5	.75	1.25	1.05	1.05	2.4	4.3	3.5	2.3	2.3	2.2	1.3	1.0
6	.75	1.15	1.05	1.05	2.5	4.4	3.5	2.3	2.5	2.15	1.3	1.0
7	.75	1.05	.95	1.05	2.8	4.3	3.5	2.35	2.5	2.1	1.3	1.0
8	.85	.95	.95	1.05	2.95	4.2	3.4	2.4	2.45	2.0	1.2	1.0
9	.95	.95	.95	1.05	3.0	4.2	3.3	2.4	2.4	1.95	1.2	1.0
10	1.05	.85	.95	1.05	3.1	4.2	3.2	2.4	2.4	1.85	1.1	.85
11	1.05	.85	.95	1.05	3.2	4.2	3.1	2.4	2.45	1.8	1.1	.85
12	1.15	.85	.95	1.05	3.1	4.3	3.1	2.35	2.45	1.8	1.0	.8
13	1.15	.75	.95	1.05	3.1	4.6	3.0	2.3	2.5	1.8	.9	.8
14	1.15	[a] .25	.95	1.05	3.1	4.7	3.0	2.3	2.5	1.75	.9	.8
15	1.15	.75	.85	1.05	3.2	4.8	3.0	2.3	2.5	1.75	.9	.75
16	1.05	.85	.85	1.05	3.6	4.9	3.0	2.25	2.5	1.7	1.0	.7
17	1.05	.95	.85	1.15	3.7	4.8	3.0	2.25	2.5	1.7	1.1	.65
18	1.05	.95	.85	1.15	3.7	4.8	3.0	2.2	2.5	1.7	1.2	.65
19	1.05	1.05	.85	1.15	3.7	4.8	3.0	2.2	2.5	1.65	1.2	.65
20	1.15	1.05	.85	1.15	3.6	4.7	3.0	2.2	2.45	1.6	1.2	.65
21	1.15	1.05	.85	1.25	3.6	4.4	2.95	2.2	2.45	1.6	1.25	.65
22	1.15	1.05	.85	1.25	3.5	4.6	2.9	2.15	2.4	1.55	1.2	.65
23	1.25	1.15	.85	1.35	3.3	4.6	2.8	2.15	2.45	1.5	1.2	.65
24	1.25	1.15	.95	1.45	3.3	4.7	2.8	2.1	2.5	1.5	1.2	.65
25	1.15	1.05	.95	1.45	3.2	4.6	2.8	2.1	2.55	1.5	1.2	.65
26	1.25	.95	.95	1.45	3.2	4.5	2.75	2.1	2.5	1.5	1.2	.65
27	1.25	.95	.95	1.65	3.2	4.3	2.7	2.1	2.5	1.5	1.1	.65
28	1.25	1.05	.95	1.85	3.1	4.1	2.65	2.15	2.45	1.5	1.1	.65
29	1.25	.....	.95	1.95	2.9	4.0	2.6	2.1	2.4	1.5	1.0	.65
30	1.35	.....	.95	1.95	2.8	4.0	2.6	2.0	2.35	1.45	1.0	.65
31	1.35	.....	.95	.....	2.7	.....	2.6	1.95	.....	1.35	.....	.65

[a] Feb. 14.—Extremely low stage due to water being held back by ice at outlet of St. Mary Lake at time of observation; mean gage height for day probably greater.

NOTE.—Relation of gage height to discharge probably affected by ice about Jan. 10 to Feb. 7 and Feb. 19 to Mar. 3.

Daily discharge, in second-feet, of St. Mary River near Babb, Mont., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	22	.....	.....	80	500	815	1,520	675	370	550	182	90
2	33	.....	.....	80	500	1,130	1,440	650	370	525	182	90
3	62	.....	.....	102	500	1,200	1,200	650	370	525	167	90
4	46	.....	80	102	550	1,680	1,280	600	500	500	167	90
5	46	.....	102	102	600	1,920	1,280	550	550	500	167	90
6	46	.....	102	102	650	2,010	1,280	550	650	475	167	90
7	46	.....	80	102	815	1,920	1,280	575	650	450	167	90
8	62	80	80	102	905	1,840	1,200	600	625	410	139	90
9	80	80	80	102	935	1,840	1,130	600	600	390	139	90
10	.....	62	80	102	995	1,840	1,060	600	600	350	113	62
11	.....	62	80	102	1,060	1,840	995	600	625	330	113	62
12	.....	62	80	102	995	1,920	895	575	625	330	90	53
13	.....	46	80	102	995	2,190	935	550	650	330	70	53
14	.....	4	80	102	995	2,280	935	550	650	312	70	53
15	.....	46	62	102	1,060	2,370	935	550	650	312	70	46
16	.....	62	62	102	1,360	2,460	935	525	650	295	90	39
17	.....	80	62	126	1,440	2,370	935	525	650	295	113	33
18	.....	80	62	126	1,440	2,370	935	500	650	295	139	33
19	.....	.....	62	126	1,440	2,370	935	500	650	278	139	33
20	.....	.....	62	126	1,360	2,280	935	500	625	262	139	33
21	.....	.....	62	153	1,360	2,010	905	500	625	262	153	33
22	.....	.....	62	153	1,280	2,190	875	475	600	246	139	33
23	.....	.....	62	182	1,130	2,190	815	475	625	229	139	33
24	.....	.....	80	213	1,130	2,280	815	450	650	229	139	33
25	.....	.....	80	213	1,060	2,190	815	450	675	229	139	33
26	.....	.....	80	213	1,060	2,100	785	450	650	229	139	33
27	.....	.....	80	278	1,060	1,920	755	450	650	229	113	33
28	.....	.....	80	350	995	1,760	728	475	625	229	113	33
29	.....	.....	80	390	875	1,680	700	450	600	229	90	33
30	.....	.....	80	390	815	1,680	700	410	575	213	90	33
31	.....	.....	80	.....	755	.....	700	390	.....	182	.....	33

NOTE.—Daily discharge computed from rating curve well defined between 70 and 2,190 second-feet (gage heights 0.9 and 4.6 feet), but poorly defined below 70 second-feet (gage height 0.9 foot). Discharge Jan. 10 to Feb. 7 and Feb. 19 to Mar. 3 estimated, because of ice, from climatologic records. Mean discharge Jan. 10 to Feb. 7 estimated 100 second-feet, varying from about 85 to 130 second-feet. Mean discharge Feb. 19 to Mar. 3 estimated 80 second-feet.

Monthly discharge of St. Mary River near Babb, Mont., for 1911.

[Drainage area, 177 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	22	85.3	0.482	0.56	5,240	D.
February	.....	[a] 4	77.3	.437	.46	4,290	D.
March	102	62	76.2	.431	.50	4,690	B.
April	390	80	154	.870	.97	9,160	A.
May	1,440	500	988	5.58	6.43	60,800	A.
June	2,460	815	1,950	11.0	12.27	116,000	A.
July	1,520	700	991	5.60	6.46	60,900	B.
August	675	390	529	2.99	3.45	32,500	A.
September	675	370	600	3.39	3.78	35,700	A.
October	550	182	330	1.87	2.16	20,300	A.
November	182	70	129	.729	.81	7,680	B.
December	90	33	54.0	.305	.35	3,320	C.
The year	2,460	[a] 4	498	2.81	38.20	361,000	

[a] Extremely low minimum due to water being held back by ice at outlet of St. Mary Lake Feb. 14.

NOTE.—See footnotes under table of daily discharge.

ST. MARY RIVER BELOW SWIFTCURRENT CREEK, AT BABB, MONT.

Location.—At Babb, Mont., about 1 mile below the mouth of Swiftcurrent Creek.

Records available.—July 14, 1901, to October 18, 1902, and May 13, 1910, to December 31, 1911. The records at this station for 1901 and 1902 were published in Water-Supply Paper 66 as for "St. Mary River at Main, Mont."

Drainage area.—298 square miles.

Gage.—The original gage was a staff nailed to a pier of the highway bridge at Babb. This gage was used in 1901 and 1902, and was destroyed by the flood of June 5, 1908. On May 13, 1910, a staff gage was installed on the left bank about 75 feet below the old site, and at a different datum. A temporary chain gage was also installed for low-water readings. On July 19, 1911, a new chain gage was installed on the right bank, about 100 feet farther downstream, and at a different datum.

Channel.—Liable to change.

Discharge measurements.—In 1901 and 1902, made from highway bridge; in 1910, from a footbridge 100 feet above the gage; in 1911, from a cable, 50 feet above the gage. Low-water measurements are made by wading.

Floods.—Probably the highest stage was reached June 5, 1908. No records of this flood were obtained at this point.

Winter flow.—Gage heights are affected by ice during the winter months.

Discharge measurements of St. Mary River below Swiftcurrent Creek, at Babb, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 15	B. E. Jones	3.40	[a] 89
May 4	do	5.13	[b] 1,050
6	do	5.76	[b] 1,520
June 5	do	7.66	[c] 3,210
25	W. A. Lamb	7.60	[c] 3,240
July 19[d]	do	[e] 5.60	[f] 1,340
Aug. 25	B. E. Jones	[e] 4.67	[c] 542
Oct. 12	do	[e] 4.55	500
Dec. 8	do	[e] 3.81	[g] 138

[a] Ice, measurement made by wading.
[b] Measurement made from footbridge.
[c] Measurement made from cable.
[d] July 19, new chain gage installed at different datum from that of gage previously used.
[e] The last four gage heights above were read on the new gage.
[f] Measurement made from cable. New gage installed on opposite side of river. Old gage read 5.65.
[g] Measurement made by wading above gage.

Daily gage height, in feet, of St. Mary River below Swift current Creek, at Babb, Mont., for 1911.

[Carl Giruin, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.0	4.1	3.5	3.5	4.9	6.4	6.7	5.4	4.6	5.0	4.2	3.85
2	4.1	4.1	3.4	3.5	4.9	6.8	6.6	5.4	4.6	4.95	4.2	3.8
3	4.3	4.0	3.4	3.5	5.0	7.2	6.5	5.45	4.6	4.9	4.15	3.8
4	4.3	4.0	3.3	3.5	5.2	7.6	6.6	5.3	5.3	4.85	4.1	3.8
5	4.3	3.9	3.4	3.5	5.4	7.8	6.6	5.3	5.45	4.8	4.1	3.8
6	4.3	3.8	3.5	3.5	5.8	7.4	6.7	5.2	5.4	4.75	4.1	3.8
7	4.3	3.7	3.5	3.5	5.9	7.5	6.7	5.2	5.35	4.7	3.9	3.8
8	4.2	3.6	3.4	3.5	5.9	7.4	6.6	5.25	5.3	4.7	3.85	3.8
9	4.0	3.5	3.4	3.5	6.0	7.4	6.4	5.3	5.3	4.6	3.8	3.8
10	3.8	3.4	3.4	3.5	5.9	7.4	6.2	5.3	5.3	4.6	3.8	3.75
11	3.8	3.4	3.4	3.5	5.8	7.6	5.9	5.25	5.3	4.6	3.8	3.75
12	3.7	3.4	3.3	3.6	5.8	7.7	5.8	5.2	5.3	4.55	3.8	3.7
13	3.7	3.4	3.3	3.6	5.9	7.9	5.7	5.1	5.35	4.55	3.8	3.7
14	3.6	3.3	3.3	3.5	5.9	8.0	5.6	5.1	5.35	4.5	3.9	3.7
15	3.6	3.3	3.3	3.5	6.7	8.0	5.6	5.0	5.35	4.5	4.0	3.65

Daily gage height, in feet, of St. Mary River below Swiftcurrent Creek, at Babb, Mont., for 1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	3.5	3.4	3.3	3.6	6.8	7.8	5.6	5.0	5.3	4.5	4.1	3.65
17	3.5	3.4	3.3	3.6	6.8	7.8	5.7	5.0	5.3	4.5	4.1	3.6
18	3.5	3.5	3.3	3.6	6.7	7.8	5.7	4.95	5.35	4.45	4.1	3.6
19	3.5	3.5	3.4	3.7	6.6	7.8	5.6	4.95	5.35	4.4	4.1	3.6
20	3.5	3.5	3.4	3.8	6.6	7.7	5.65	4.9	5.3	4.4	4.1	3.6
21	3.5	3.4	3.4	4.0	6.4	7.4	5.6	4.9	5.3	4.4	4.1	3.6
22	3.6	3.4	3.4	4.1	6.4	7.4	5.6	4.85	5.25	4.35	4.1	3.6
23	3.6	3.4	3.4	4.2	6.1	7.4	5.5	4.8	5.3	4.35	4.0	3.6
24	3.7	3.4	3.5	4.4	6.1	7.5	5.5	4.75	5.35	4.35	4.0	3.6
25	3.6	3.4	3.5	4.6	6.0	7.6	5.4	4.7	5.4	4.35	4.0	3.6
26	3.7	3.4	3.5	4.7	5.9	7.3	5.4	4.7	5.35	4.35	4.0	3.6
27	3.8	3.5	3.5	4.8	5.8	7.2	5.35	4.65	5.3	4.35	4.0	3.8
28	3.9	3.5	3.5	4.9	5.7	7.0	5.3	4.65	5.25	4.3	4.0	4.0
29	3.9	.....	3.5	4.9	5.5	6.8	5.3	4.65	5.2	4.3	3.9	4.0
30	4.0	.....	3.5	4.9	5.6	7.0	5.3	4.6	5.1	4.25	3.85	4.0
31	4.1	.....	3.5	.....	5.6	.....	5.35	4.6	.....	4.2	.....	4.0

NOTE.—Relation of gage height to discharge affected by ice Jan. 1 to Mar. 3 and Dec. 26 to 31.

Daily discharge, in second-feet, of St. Mary River below Swiftcurrent Creek, at Babb, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	170	895	2,070	2,340	1,150	512	805	291	152
2	.....	170	895	2,430	2,250	1,150	512	765	291	135
3	.....	170	960	2,800	2,160	1,200	512	725	268	135
4	95	170	1,100	3,180	2,250	1,060	1,060	687	246	135
5	130	170	1,240	3,360	2,250	1,060	1,200	649	246	135
6	170	170	1,560	2,980	2,340	973	1,150	614	246	135
7	170	170	1,640	3,080	2,340	973	1,100	578	168	135
8	130	170	1,640	2,980	2,250	1,020	1,060	578	152	135
9	130	170	1,720	2,980	2,070	1,060	1,060	512	135	135
10	130	170	1,640	2,980	1,890	1,060	1,060	512	135	120
11	130	170	1,560	3,180	1,640	1,020	1,060	512	135	120
12	95	210	1,560	3,270	1,560	973	1,060	482	135	106
13	95	210	1,640	3,460	1,480	888	1,100	482	135	106
14	95	170	1,640	3,560	1,400	888	1,100	451	168	106
15	95	170	2,340	3,560	1,400	805	1,100	451	205	93
16	95	210	2,430	3,360	1,400	805	1,060	451	246	93
17	95	210	2,430	3,360	1,480	805	1,060	451	246	80
18	95	210	2,340	3,360	1,480	765	1,100	422	246	80
19	130	255	2,250	3,360	1,340	765	1,100	394	246	80
20	130	300	2,250	3,270	1,390	725	1,060	394	246	80
21	130	395	2,070	2,980	1,340	725	1,060	394	246	80
22	130	445	2,070	2,980	1,340	687	1,020	368	246	80
23	130	495	1,800	2,980	1,240	649	1,060	368	205	80
24	170	600	1,800	3,080	1,240	614	1,100	368	205	80
25	170	710	1,720	3,180	1,150	578	1,150	368	205	80
26	170	770	1,640	2,890	1,150	578	1,100	368	205	.....
27	170	830	1,560	2,800	1,100	545	1,060	368	205	.....
28	170	895	1,480	2,610	1,060	545	1,020	341	205	.....
29	170	895	1,320	2,430	1,060	545	973	341	168	.....
30	170	895	1,400	2,610	1,060	512	888	316	152	.....
31	170	.....	1,400	.....	1,100	512	.....	291	.....	.....

NOTE.—Daily discharge computed from two rating curves, one, applicable Mar. 4 to July 18, well defined between 130 and 3,270 second-feet; the other, applicable July 19 to Dec. 25, fairly well defined between 135 and 1,340 second-feet.

Discharge Mar. 1 to 3, and Dec. 26 to 31 estimated, because of ice, from climatologic records and records of discharge of adjacent drainage areas.

Mean discharge Mar. 1 to 3, estimated, 95 second-feet.

Mean discharge Dec. 26 to 31, estimated, 65 second-feet.

Monthly discharge of St. Mary River below Swiftcurrent Creek, at Babb, Mont., for 1911.

[Drainage area, 298 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	155	0.520	0.60	9,530	D.
February	.....	.....	140	.470	.49	7,780	D.
March	170	95	130	.436	.50	7,990	B.
April	895	170	358	1.20	1.34	21,300	A.
May	2,430	895	1,680	5.64	6.50	103,000	A.
June	3,560	2,070	3,040	10.2	11.38	181,000	A.
July	2,340	1,060	1,600	5.37	6.19	98,400	B.
August	1,200	512	827	2.78	3.20	50,800	A.
September	1,200	512	1,020	3.42	3.82	60,700	A.
October	805	291	478	1.60	1.84	29,400	A.
November	291	135	208	.698	.77	12,400	A.
December	152	.....	99.5	.334	.39	6,120	C.
The year	3,560	.....	812	2.72	37.02	588,000	

NOTE.—Monthly mean discharge, January and February, estimated because of ice by comparison with record of discharge of St. Mary River above Swiftcurrent Creek near Babb, Mont. See footnotes to table of daily discharge.

ST. MARY RIVER NEAR CARDSTON, ALBERTA.

Location.—At Henry Cook's ranch, about half a mile north of the boundary line between the United States and Canada, and about a mile below the mouth of Boundary Creek.

Records available.—September 4, 1902, to December 31, 1911.

Drainage area.—452 square miles.

Gage.—The gage installed when the station was established was destroyed during the high water of June, 1908, and a new chain gage was installed July 19, 1908, about one-fourth mile below the cable. There is no determined relation between the two gages.

Channel.—Shifting.

Discharge measurements.—Made from a cable one-fourth mile above the gage.

Floods.—The flood of June 5, 1908, reached a gage height of about 12.75 feet above the old gage datum.

Winter flow.—Gage heights are affected by ice during the winter months.

Discharge measurements of St. Mary River near Cardston, Alberta, in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
May 5	B. E. Jones	2.87	1,240
5	.....do	2.87	1,280
June 6	.....do	5.26	3,260
7	.....do	5.14	3,220
24	W. A. Lamb	5.47	3,610
July 18	.....do	3.02	1,610
Aug. 26	B. E. Jones	1.75	698
Oct. 13	.....do	1.64	610
Dec. 7	.....do	[a] .33	223

[a] Gage height obtained with level; no ice at gage or below gage.

Daily gage height, in feet, of St. Mary River near Cardston, Alberta, for 1911.

[Mrs. H. F. Cook, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.6	2.55	2.8	0.5	2.4	4.3	4.2	2.5	3.0	2.35	1.05	.....
2	.....	.....	.....	.....	2.4	5.3	.....	2.5	3.0	2.3	1.0	.....
3	.....	.....	.....	.55	2.4	5.7	4.0	2.5	3.0	2.25	1.0	.....
4	.....	2.6	2.85	.5	2.7	5.8	3.9	2.4	3.0	2.2	.95	.....
5	1.45	.....	.....	.6	2.8	5.6	3.9	2.4	2.9	2.15	.9	.....
6	.....	2.65	2.95	.65	3.6	5.25	3.7	2.4	2.9	2.1	.9	.....
7	1.55	.....	.....	.5	3.5	5.2	3.6	2.4	2.9	1.9	.9	0.3
8	.....	2.7	2.95	.55	3.5	5.2	3.5	2.4	2.8	1.95	.85	.2
9	.....	.....	.....	.6	3.5	.....	3.5	2.4	2.8	1.9	.75	.3
10	.....	.....	2.65	.7	3.5	5.0	3.3	2.4	2.7	1.85	.75	.3
11	.....	2.8	.....	.....	3.5	5.5	3.2	2.4	2.7	1.75	.7	.35
12	.....	.....	2.7	.75	3.4	5.7	3.1	2.4	2.6	.....	.75	.35
13	.....	.....	.....	.75	3.6	5.8	3.0	2.5	2.6	1.65	.85	.3
14	.....	2.85	2.85	.75	3.7	5.8	3.0	2.5	2.7	1.65	.8	.2
15	2.3	.....	.....	.8	3.9	5.7	3.0	2.5	2.7	1.55	.85	.1
16	.....	2.9	3.25	.8	5.8	5.6	3.0	2.4	2.8	1.55	.85	.....
17	.....	.....	.....	.95	5.4	5.7	3.0	2.4	2.7	1.45	.8	.3
18	2.55	2.85	.....	1.0	5.1	5.7	3.0	2.4	2.6	1.4	.9	.3
19	.....	.....	3.2	1.25	5.0	5.6	3.0	2.3	2.7	1.4	1.0	.25
20	.....	2.8	.....	1.2	4.6	5.5	3.0	2.2	2.7	1.4	1.05	.25
21	2.45	.....	3.55	2.4	4.3	5.4	3.0	2.0	2.7	1.35	1.0	.2
22	.....	.....	4.0	2.2	4.3	5.2	2.9	2.0	2.8	1.35	.95	.2
23	2.3	2.9	4.05	2.3	.....	5.2	2.9	2.0	2.9	1.3	.95	.3
24	.....	.....	4.15	.....	4.8	5.4	2.7	2.0	2.8	1.3	.95	.3
25	.....	2.85	4.0	2.5	4.9	5.6	2.7	1.85	.....	1.25	.9	.3
26	2.35	.....	3.1	.....	4.9	5.4	2.6	1.8	.....	1.25	.....	.2
27	.....	2.7	3.2	2.6	3.6	5.5	2.6	1.75	2.6	1.25	.....	.15
28	2.4	2.8	3.15	2.5	3.4	4.8	2.6	1.9	2.6	1.15	.....	.....
29	.....	.....	3.0	2.5	3.2	4.8	2.6	2.0	2.5	1.1	.....	.....
30	2.45	.....	2.05	2.4	3.2	4.6	2.5	3.4	2.4	1.1	.....	2.0
31	.....	.....	2.2	.....	3.5	.....	2.5	3.4	.....	1.05	.....	2.2

NOTE.—Relation of gage height to discharge probably affected by ice about Jan. 1 to Mar. 31, Nov. 10 to 16, and Dec. 16 to 31. On Mar. 22 the observer reported "Ice going out." Gage heights Dec. 7 to 27 read from temporary iron rod gage driven in bed of stream, and then reduced to regular gage datum.

Daily discharge, in second-feet, of St. Mary River near Cardston, Alberta, for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	177	952	2,380	2,470	1,190	1,440	992	398	310
2	181	952	3,320	2,390	1,190	1,440	963	390	295
3	185	952	3,710	2,310	1,190	1,440	929	390	280
4	177	1,140	3,810	2,230	1,100	1,440	901	371	265
5	193	1,200	3,610	2,230	1,100	1,370	873	351	250
6	203	1,790	3,260	2,070	1,100	1,370	846	351	235
7	177	1,710	3,280	1,990	1,100	1,370	741	351	217
8	185	1,710	3,280	1,930	1,100	1,290	766	344	202
9	193	1,710	3,190	1,930	1,100	1,290	741	308	217
10	213	1,710	3,100	1,770	1,100	1,230	711	280	217
11	219	1,710	3,580	1,700	1,100	1,230	663	240	226
12	225	1,640	3,790	1,640	1,100	1,160	639	210	226
13	225	1,790	3,890	1,580	1,150	1,160	615	200	217
14	225	1,870	3,890	1,580	1,150	1,220	615	210	202
15	237	2,040	3,800	1,580	1,150	1,220	570	240	190
16	237	3,810	3,700	1,580	1,070	1,290	570	280	190
17	283	3,410	3,810	1,580	1,070	1,220	539	347	190
18	300	3,120	3,810	1,580	1,070	1,160	517	387	180
19	398	3,030	3,720	1,580	1,010	1,210	517	426	180
20	377	2,650	3,620	1,580	952	1,210	517	446	170
21	952	2,380	3,530	1,580	830	1,210	496	438	170
22	842	2,380	3,340	1,500	830	1,280	496	418	170
23	896	2,610	3,340	1,500	830	1,350	487	418	160
24	953	2,840	3,540	1,350	830	1,280	487	418	160
25	1,010	2,930	3,750	1,350	746	1,230	467	398	160
26	1,040	2,930	3,550	1,270	721	1,180	467	383	150
27	1,070	1,790	3,670	1,270	696	1,140	467	370	150
28	1,010	1,640	3,000	1,270	772	1,140	438	355	140
29	1,010	1,490	3,000	1,270	825	1,080	418	340	120
30	952	1,490	2,830	1,190	1,740	1,020	418	325	110
31	.....	1,710	.....	1,190	1,740	.....	398	.....	100

NOTE.—Daily discharge determined by means of a discharge rating curve fairly well defined between 350 and 3,600 second-feet. The shifting-channel method was used, each discharge measurement made during the year being given full weight. Discharge interpolated for days on which gage was not read. Discharge Jan. 1 to Mar. 31, Nov. 10 to 16, and Dec. 16 to 31 estimated, because of ice, from climatologic records and discharge of St. Mary River below Swiftcurrent Creek, near Babb, Mont.

Monthly discharge of St. Mary River near Cardston, Alberta, for 1911.

[Drainage area, 452 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January			[a] 170	0.376	0.43	10,500	D.
February			[a] 150	.332	.35	8,330	D.
March			[a] 145	.321	.37	8,920	D.
April	1,040	177	478	1.06	1.18	28,400	C.
May	3,810	952	2,040	4.51	5.20	125,000	A.
June	3,890	2,380	3,470	7.68	8.57	206,000	A.
July	2,470	1,190	1,680	3.72	4.29	103,000	A.
August	1,740	696	1,050	2.32	2.68	64,600	A.
September	1,440	1,020	1,260	2.79	3.11	75,000	A.
October	992	398	621	1.37	1.58	38,200	B.
November	446	[a] 200	346	.765	.85	20,600	B.
December	310	[a] 100	195	.431	.50	12,000	C.
The year	3,890		968	2.14	29.11	701,000	

[a] Estimated.

NOTE.—See footnotes to tables of daily gage height and daily discharge.

RED RIVER BASIN.

OTTER TAIL RIVER NEAR FERGUS FALLS, MINN.

Location.—Threemile Bridge, 3½ miles northeast of Fergus Falls, between secs. 18 and 19, T. 133 N., R. 42 W., several miles above the outlet of Wall Lake, and 20 miles below Otter Tail Lake, through which the river flows.

Records available.—May 9, 1904, to December 31, 1911. A gaging station was maintained from May 1, 1899, to May 14, 1904, by the United States Engineer Corps at the outlet of Otter Tail Lake, where the drainage area is about 12 per cent less than at the Geological Survey station, with no important tributaries intervening. The observations at Fergus Falls in connection with those at the outlet of Otter Tail Lake furnish a 13-year record of flow of the river below Otter Tail Lake.

Drainage area.—1,310 square miles.

Gage.—Chain attached to the bridge; datum unchanged since establishment.

Channel.—Practically permanent.

Discharge measurements.—Discharge measurements are made from the bridge except at extreme low stages, when they are made at a wading section.

Winter flow.—The river is frozen over from December to March, and measurements are made to determine the winter flow.

Regulation.—Otter Tail Lake, about 22 square miles in area, forms a natural reservoir, regulating the flow of the river to such an extent that the recorded range of stage has not exceeded 2 feet.

On the upper part of the river are a number of dams used in driving logs to the sawmill at Frazee, where the lowest dam is built. The next dam below Frazee is at Maine, several miles below Otter Tail Lake, about sec. 35, T. 134 N., R. 41 W. During the low-water season the closing of the turbine gates at Maine may have an effect on the flow immediately below the dam, but small lakes through which the river flows before reaching the gaging station tend to equalize the flow at the latter point. Below the station there are a number of power plants, but owing to the fall of the river their influence is not observable at the gage.

The following discharge measurement was made by W. G. Hoyt and S. B. Soulé: December 16, 1911: Gage height, 3.44 feet; discharge, 119 second-feet. Complete ice cover; average thickness of ice 0.92 foot.

Daily gage height, in feet, of Otter Tail River near Fergus Falls, Minn., for 1911.

[O. Tommerdahl and H. G. Evensen, jr., observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					2.75	2.75	2.45	2.35	2.4	2.5	2.6	
2		4.0		2.7	2.75	2.75	2.4	2.4	2.35	2.55	2.55	3.1
3			4.8	2.65	2.75	2.75	2.45	2.45	2.4	2.55	2.6	
4				2.7	2.8	2.75	2.45	2.45	2.35	2.6	2.55	3.25
5	3.6			2.65	2.75	2.75	2.45	2.45	2.4	2.55	2.55	
6				2.65	2.75	2.7	2.45	2.4	2.45	2.55	2.55	
7				2.65	2.7	2.7	2.4	2.45	2.4	2.6	2.55	
8				2.7	2.7	2.7	2.45	2.45	2.45	2.55	2.55	
9			4.7	2.75	2.75	2.7	2.45	2.5	2.4	2.6	2.5	3.3
10				2.75	2.75	2.7	2.45	2.5	2.45	2.6	2.55	
11		4.2		2.85	2.75	2.65	2.4	2.55	2.45	2.6	2.6	3.35
12				2.85	2.75	2.65	2.35	2.55	2.4	2.65		
13	3.4			2.85	2.75	2.6	2.4	2.5	2.5	2.6	2.65	
14				2.85	2.75	2.6	2.35	2.55	2.45	2.65		
15				2.8	2.75	2.6	2.35	2.5	2.5	2.6		
16		4.35	3.3	2.8	2.75	2.6	2.35	2.5	2.5	2.6	2.75	3.35
17				2.85	2.8	2.55	2.35	2.5	2.45	2.65		3.3
18				2.85	2.8	2.55	2.35	2.45	2.5	2.6		
19				2.9	2.8	2.55	2.35	2.5	2.5	2.65		
20	3.65			2.8	2.8	2.55	2.35	2.45	2.55	2.6	2.75	
21				2.8	2.8	2.5	2.4	2.5	2.5	2.6		
22			2.9	2.75	2.8	2.5	2.4	2.5	2.5	2.6		
23		4.6		2.75	2.75	2.5	2.35	2.4	2.45	2.55		3.35
24				2.85	2.75	2.45	2.4	2.45	2.5	2.6		
25				2.8	2.75	2.45	2.35	2.4	2.45	2.55	2.8	3.4
26	3.7		2.6	2.8	2.75	2.45	2.35	2.45	2.5	2.55		
27			2.7	2.8	2.75	2.45	2.35	2.45	2.55	2.6	3.0	
28			2.7	2.8	2.75	2.5	2.35	2.35	2.5	2.55		
29			2.75	2.85	2.75	2.5	2.35	2.4	2.55	2.6		
30			2.8	2.8	2.75	2.45	2.35	2.35	2.5	2.55		3.6
31			2.8		2.75		2.4	2.4		2.55		

NOTE.—Ice present from Jan. 1 to Mar. 25, average thickness of ice about 1.5 to 2 feet; and from Nov. 11 to Dec. 31, average thickness of ice about 0.5 to 1 foot.

Daily discharge, in second-feet, of Otter Tail River near Fergus Falls, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		218	218	218	124	98	111	138	168
2		201	218	218	111	111	98	153	153
3		184	218	218	124	124	111	153	168
4		201	236	218	124	124	98	168	153
5		184	218	218	124	124	111	153	153
6		184	218	201	124	111	124	153	153
7		184	201	201	111	124	111	168	153
8		201	201	201	124	124	124	153	153
9		218	218	201	124	138	111	168	138
10		218	218	201	124	138	124	168	153
11		255	218	184	111	153	124	168	
12		255	218	184	98	153	111	184	
13		255	218	168	111	138	138	168	
14		255	218	168	98	153	124	184	
15		236	218	168	98	138	138	168	
16		236	218	168	98	138	138	168	
17		255	236	153	98	138	124	184	
18		255	236	153	98	124	138	168	
19		274	236	153	98	138	138	184	
20		236	236	153	98	124	153	168	
21		236	236	138	111	138	138	168	
22		218	236	138	111	138	138	168	
23		218	218	138	98	111	124	153	
24		255	218	124	111	124	138	168	
25		236	218	124	98	111	124	153	
26	168	236	218	124	98	124	138	153	
27	201	236	218	124	98	124	153	168	
28	201	236	218	138	98	98	138	153	
29	218	255	218	138	98	111	153	168	
30	236	236	218	124	98	98	138	153	
31	236		218		111	111		153	

NOTE.—Daily discharge computed from a well-defined rating curve. Discharge Jan. 1 to Mar. 25 and Nov. 12 to Dec. 31 estimated, because of ice, from discharge measurement, gage observer's notes, and climatologic records. Mean discharge Jan. 1 to 31 estimated 80 second-feet. Mean discharge Feb. 1 to 28 estimated 85 second-feet. Mean discharge Mar. 1 to 25 estimated 105 second-feet. Mean discharge Nov. 12 to 30 estimated 115 second-feet, varying from about 100 to 150 second-feet. Mean discharge Dec. 1 to 31 estimated 110 second-feet, varying from about 80 to 130 second-feet. Discharge Apr. 1 interpolated.

Monthly discharge of Otter Tail River near Fergus Falls, Minn., for 1911.

[Drainage area, 1,310 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	80	0.061	0.07	4,920	B.
February	.....	.....	85	.065	.07	4,720	B.
March	.....	.....	125	.095	.11	7,690	C.
April	274	184	229	.175	.20	13,600	A.
May	236	201	221	.169	.19	13,600	A.
June	218	124	169	.129	.14	10,100	A.
July	124	98	108	.082	.09	6,640	A.
August	153	98	126	.096	.11	7,750	A.
September	153	98	128	.098	.11	7,620	A.
October	184	138	164	.125	.14	10,100	A.
November	168	.....	128	.098	.11	7,620	B.
December	.....	.....	110	.084	.10	6,760	B.
The year	274	.....	140	.107	1.44	101,000	

NOTE.—See footnotes to table of daily discharge.

RED RIVER AT FARGO, N. DAK.

Location.—At the highway bridge connecting Front Street, Fargo, N. Dak., with Moorhead, Minn., 10 miles above the mouth of Sheyenne River.

Records available.—May 27, 1901, to December 31, 1911.

Drainage area.—6,020 square miles.

Gage.—Vertical staff attached to the breakwater for the center pier of the Front Street Bridge; read from the bridge or the river banks by the aid of a field glass; datum unchanged since establishment.

Channel.—Clay and silt; slightly shifting.

Discharge measurements.—From the Front Street Bridge and the Northern Pacific Railway bridge.

Regulation.—There is a low dam of steel sheet-piling a few rods below the foot-bridge at Fargo Waterworks, one-half mile above the gage. This dam, a tight overflow weir without sluices, was built in August, 1910, for the purpose of maintaining a sufficient depth of water for the intake pipe of the waterworks, and raises the water about 5 feet at lowest stage. Conditions of flow at the gage are not affected by this dam.

Winter flow.—The relation of gage height to discharge is affected by ice from about the middle of November to the first of April, and during this time observations are discontinued. At the spring break-up, on account of the comparatively sluggish current and the fact that the river flows northward into a colder district, a pronounced backwater effect is usually caused by ice jams and partial ice jams.

Accuracy.—Because of the inaccessibility of the gage, the relatively poor conditions for making accurate discharge measurements, and the slightly shifting channel, the records are not considered better than fair.

Discharge measurements of Red River at Fargo, N. Dak., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
une 24	E. F. Chandler	6.70	143
ug. 21	do	6.73	161

NOTE.—Measurements made from Front Street Bridge.

Daily gage height, in feet, of Red River at Fargo, N. Dak., for 1911.

[Mrs. H. R. Grasse, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	6.2	7.7	7.4	7.2	6.6	6.6	6.6	7.0	.....
2	.....	7.7	7.4	7.3	6.6	6.6	6.6	6.9	.....
3	.....	7.7	7.4	7.5	6.6	6.6	6.6	6.8	.....
4	.....	7.8	7.5	8.0	6.5	6.5	6.5	6.7	.....
5	.....	7.8	7.5	8.0	6.4	6.7	6.5	6.7	6.6
6	.....	7.5	7.4	8.0	6.5	6.8	6.5	7.5	6.6
7	6.4	7.5	7.4	7.9	6.5	7.0	6.5	7.6	7.1
8	6.5	7.5	7.3	7.8	6.5	7.1	6.7	7.7	7.2
9	6.5	7.5	7.3	7.7	6.5	7.0	6.8	7.2	7.2
10	6.6	8.0	7.4	7.7	6.5	7.1	6.7	7.3	.....
11	6.7	8.7	7.4	7.2	6.3	7.1	6.5	7.3	.....
12	6.8	8.3	7.5	7.3	6.3	7.1	6.7	7.2	.....
13	6.9	8.2	7.5	7.3	6.3	7.1	6.7	7.1	.....
14	7.0	8.0	7.4	7.3	6.3	7.1	6.8	7.1	.....
15	7.2	8.0	7.5	7.3	6.2	7.0	6.9	7.2	.....
16	7.2	8.0	7.5	7.2	6.2	6.9	6.8	7.2	.....
17	7.7	8.0	7.5	7.1	6.3	6.9	6.9	7.2	.....
18	7.8	7.8	7.5	7.0	6.3	6.9	7.1	7.2	.....
19	7.9	7.8	7.5	6.9	6.2	6.8	6.9	7.3	.....
20	8.0	7.6	7.5	6.8	6.2	6.7	6.9	7.3	.....
21	8.1	7.7	7.5	6.8	6.2	6.6	6.9	7.3	.....
22	8.1	7.8	7.4	6.8	6.2	6.7	6.7	7.3	.....
23	8.0	7.6	7.4	6.5	6.2	6.7	6.8	7.3	.....
24	8.1	7.6	7.4	6.5	6.3	6.7	6.9	7.3	.....
25	8.1	7.6	7.2	6.5	6.3	6.7	6.9	7.3	.....
26	8.2	7.6	7.2	6.6	6.3	6.6	6.9	7.3	.....
27	8.5	7.5	7.2	6.5	6.5	6.6	6.9	7.3	.....
28	7.9	7.4	7.2	6.5	6.4	6.7	6.9	7.3	.....
29	7.5	7.4	7.2	6.6	6.5	6.7	7.0	.....	.....
30	7.5	7.4	7.2	6.6	6.6	6.7	7.0	.....	.....
31	7.5	.....	7.2	.....	6.6	6.6	.....	.....	.....

NOTE.—Ice present Jan. 1 to Mar. 16 and Nov. 9 to Dec. 31.

Daily discharge, in second-feet, of Red River at Fargo, N. Dak., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	356	286	242	131	131	131	201
2	.....	356	286	264	131	131	131	182
3	.....	356	286	309	131	131	131	164
4	.....	380	309	428	116	116	116	147
5	.....	380	309	428	102	147	116	147
6	.....	309	286	428	116	164	116	309
7	.....	309	286	404	116	201	116	332
8	.....	309	264	380	116	221	147	356
9	.....	309	264	356	116	201	164	242
10	.....	428	286	356	116	221	147	264
11	.....	608	286	242	90	221	116	264
12	.....	504	309	264	90	221	147	242
13	.....	474	309	264	90	221	147	221
14	.....	428	286	264	90	221	164	221
15	.....	428	309	264	79	201	182	242
16	.....	428	309	242	79	182	164	242
17	356	428	309	221	90	182	182	242
18	380	380	309	201	90	182	221	242
19	404	380	309	182	79	164	182	264
20	428	332	309	164	79	147	182	264
21	453	356	309	164	79	131	182	264
22	453	380	286	164	79	147	147	264
23	428	332	286	116	79	147	164	264
24	453	332	286	116	90	147	182	264
25	453	332	242	116	90	147	182	264
26	478	332	242	131	90	131	182	264
27	556	309	242	116	116	131	182	264
28	404	286	242	116	102	147	182	264
29	309	286	242	131	116	147	201	[a] 250
30	309	286	242	131	131	147	201	[a] 230
31	309	.....	242	.....	131	131	.....	[a] 210

[a] Daily discharge estimated.

NOTE.—Discharge Mar. 1 to 16 estimated, because of ice, from observer's notes, climatologic records, and discharge of adjacent drainage areas. Mean discharge Mar. 1 to 16 estimated 90 second-feet, varying from about 60 to 130 second-feet.

Monthly discharge of Red River at Fargo, N. Dak., for 1911.

[Drainage area, 6,020 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
March	556	60	246	0.041	0.05	15,100	C.
April	608	286	370	.062	.07	22,000	B.
May	309	242	283	.047	.05	17,400	B.
June	428	116	240	.040	.04	14,300	B.
July	131	79	102	.017	.02	6,270	B.
August	221	116	166	.028	.03	10,200	B.
September	221	116	160	.027	.03	9,520	B.
October	356	147	245	.041	.05	15,100	C.
The period						110,000	

NOTE.—See footnotes to tables of daily gage height and daily discharge.

RED RIVER AT GRAND FORKS, N. DAK.

Location.—At the Northern Pacific Railway bridge between Grand Forks, N. Dak., and East Grand Forks, Minn., about half a mile below the mouth of Red Lake River.

Records available.—May 26, 1901, to December 31, 1911. Gage-height records have, however, been kept by the United States Engineer Corps for about 30 years at this point.

Drainage area.—25,000 square miles.

Gages.—Staff and chain, attached to Northern Pacific Railway bridge; datum same for both and unchanged since establishment. As a rule, the chain gage is read only during periods of extremely low water. The United States Engineer Corps gage is located on the breakwater to which the United States Geological Survey staff gage is attached, but at a datum 5 feet higher.

Channel.—Clay and silt; shifts slightly.

Discharge measurements.—Made from the Great Northern Railway bridge about one-fifth mile above the gage.

Regulation.—There are no dams or other obstructions below, nor rapids, the channel being fairly uniform for miles. Above there are no power plants, dams, or reservoirs affecting the flow nearer than Crookston, on Red Lake River, 25 miles above Grand Forks, along the general course of the valley; about half the water comes from Red Lake River, but the storage at the Crookston plant is so small that no fluctuations caused by it have been discovered at Grand Forks. On the other branch, the Red River proper, and its tributaries above Grand Forks, there are no reservoirs or power plants for a hundred miles above.

Winter flow.—The river flows under smooth ice from about the middle of November to the middle of April; the flow during the winter fluctuates little, and since 1895 enough discharge measurements have been made each winter to give fairly satisfactory summaries for the winter.

When the ice breaks up in the spring, because the river has only a gentle current and because it flows north into cooler regions where the river is not yet open, the gage reading is usually excessively and disproportionately high for a few days or weeks, so that the figures for quantity of flow must depend largely on estimation; actual measurements when the river appeared entirely open and clear of ice at this point have sometimes shown the gage reading to be 5 feet greater than would have been needed for the same discharge later in the season, after the whole length of the river was entirely open.

Discharge measurements of Red River at Grand Forks, N. Dak., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 14	Chandler and Monley	[a] 4.10	198
18	Goric Monley	[b] 4.11	177
25	do	[c] 4.33	235
May 13	Chandler and Monley	7.13	1,740
July 18	E. F. Chandler	3.81	542

[a] Measurement Feb. 14 affected by ice. Mean lower surface of ice=2.60 feet on gage.
[b] Measurement Feb. 18 affected by ice. Mean lower surface of ice=2.48 feet on gage.
[c] Measurement Feb. 25 affected by ice. Mean lower surface of ice=2.88 feet on gage.

NOTE.—All measurements made at Great Northern Railway bridge.

Daily gage height, in feet, of Red River at Grand Forks, N. Dak., for 1911.

[J. F. Hayes, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1				9.25	6.75	5.95	5.58	2.70	3.10	3.00	3.6	
2				9.42	6.52	6.00	5.15	2.72	3.20	2.95	3.6	3.3
3				8.80	6.50	6.25	5.10	2.80	3.25	2.70	3.4	
4		3.65	4.5	8.60	6.39	6.42	5.00	2.90	3.05	2.70	3.4	
5				8.40	6.32	6.82	4.95	3.20	3.00	2.60		
6				8.20	6.15	6.55	4.80	3.20	2.92	2.55		
7				7.75	6.00	6.40	4.60	3.22	3.05	2.30		
8				7.60	5.92	6.55	4.72	3.30	3.15	2.90		
9	4.1			7.58	5.90	6.80	4.62	3.40	3.00	3.00		3.4
10				7.75	6.05	7.85	4.58	3.30	2.95	3.05		
11		3.8	4.8	7.95	6.10	10.10	4.62	3.25	2.95	3.10	3.5	
12				8.20	6.18	10.65	4.50	3.18	3.10	3.05		
13				8.40	6.76	10.55	4.20	3.20	3.00	2.60		
14	3.7	4.1		8.90	7.05	9.85	4.00	3.30	3.00	3.30		
15				9.18	6.80	8.95	3.90	3.42	3.05	3.30		
16				9.02	6.58	8.32	3.70	3.40	3.00	3.20		3.5
17				8.85	6.75	7.92	3.65	3.45	3.25	3.45		
18		4.0	6.0	8.65	8.15	7.45	3.55	3.28	3.40	3.72	3.3	
19				8.45	8.50	7.35	3.42	3.00	3.38	4.00		
20				8.10	7.74	7.08	3.38	2.90	3.05	3.90		
21	3.7			7.50	7.66	7.08	3.22	2.82	3.00	3.90		
22				7.11	7.68	6.75	3.02	2.80	2.92	4.00		
23				7.00	7.35	6.20	2.92	2.82	3.15	4.05		3.8
24				6.95	7.00	6.14	2.80	2.82	3.00	4.18		
25		4.35	8.65	6.90	6.75	6.10	2.78	2.78	3.02	4.22	3.0	
26				6.88	6.50	5.82	2.80	2.92	3.12	4.15		
27				6.88	6.20	5.60	2.80	2.90	3.18	4.10		
28	3.9			6.71	5.80	5.55	2.70	2.82	2.80	4.00		
29				7.02	5.72	5.60	2.71	2.95	2.90	4.05		
30				6.98	5.80	5.55	2.62	3.10	2.95	3.95		3.5
31			9.45		5.90		2.62	3.08		3.90		

NOTE.—Relation of gage height to discharge affected by ice about Jan. 1 to Apr. 9 and Oct. 29 to Dec. 31.

Daily discharge, in second-feet, of Red River at Grand Forks, N. Dak., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	1,550	1,210	1,060	331	397	380
2	.....	1,440	1,220	914	334	415	372
3	.....	1,440	1,330	897	347	424	331
4	.....	1,390	1,400	865	363	388	331
5	.....	1,360	1,580	850	415	380	315
6	.....	1,290	1,460	803	415	366	308
7	.....	1,220	1,390	744	419	388	271
8	.....	1,190	1,460	779	434	406	363
9	.....	1,190	1,570	750	454	380	380
10	2,020	1,240	2,060	738	434	372	388
11	2,110	1,260	3,200	750	424	372	397
12	2,230	1,300	3,500	715	411	397	388
13	2,330	1,550	3,440	634	415	380	315
14	2,580	1,680	3,070	585	434	380	434
15	2,720	1,570	2,600	562	458	388	434
16	2,640	1,470	2,290	518	454	380	415
17	2,560	1,550	2,100	507	464	424	464
18	2,460	2,210	1,870	486	430	454	522
19	2,360	2,380	1,820	458	380	450	585
20	2,180	2,010	1,700	450	363	388	562
21	1,900	1,970	1,700	419	350	380	562
22	1,710	1,980	1,550	383	347	366	585
23	1,660	1,820	1,310	366	350	406	597
24	1,640	1,660	1,280	347	350	380	629
25	1,610	1,550	1,260	344	344	383	639
26	1,600	1,440	1,150	347	366	401	622
27	1,600	1,310	1,070	347	363	411	609
28	1,530	1,150	1,050	331	350	347	585
29	1,670	1,120	1,070	333	372	363	550
30	1,650	1,150	1,050	318	397	372	525
31	.....	1,190	.....	318	394	.....	500

NOTE.—Daily discharge computed from a rating curve well defined between 475 and 10,000 second-feet. Discharge Jan. 1 to Apr. 9 and Oct. 29 to Dec. 31 estimated, because of ice, from discharge measurements, weekly gage heights, gage observer's notes, climatologic records, and discharge of adjacent drainage areas. Mean discharge Apr. 1 to 9, estimated, 1,500 second-feet.

Monthly discharge of Red River at Grand Forks, N. Dak., for 1911.

[Drainage area, 25,000 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a] 210	0.0084	0.01	12,900	C.
February	.....	.....	[a] 185	.0074	.008	10,300	B.
March	.....	.....	[a] 760	.030	.03	46,700	C.
April	2,720	.....	1,880	.075	.08	112,000	B.
May	2,380	1,120	1,500	.060	.07	92,200	A.
June	3,500	1,050	1,760	.070	.08	105,000	A.
July	1,060	318	578	.023	.03	35,500	A.
August	464	331	392	.016	.02	24,100	B.
September	454	347	391	.016	.02	23,300	B.
October	639	271	463	.018	.02	28,500	B.
November	.....	.....	[a] 370	.015	.02	22,000	C.
December	.....	.....	[a] 340	.014	.02	20,900	D.
The year	3,500	.....	736	.029	.41	533,000	

[a] Estimated. See footnotes to table of daily discharge.

PELICAN RIVER NEAR FERGUS FALLS, MINN.

Location.—At the private highway bridge 6 miles northwest of Fergus Falls, in section 18 of that township, about 5 miles above junction with Otter Tail River.

Records available.—June 19, 1909, to December 31, 1911.

Drainage area.—433 square miles.

Gage.—Vertical staff; datum unchanged since established. Gage is read twice a day and the mean of the readings is recorded as the mean for the day.

Channel.—Practically permanent.

Discharge measurements.—From the bridge except at low stages, when measurements are made at a wading section.

Winter flow.—Ice is present from the middle of November to the 1st of April, and during that time discharge measurements are made to determine the winter flow.

Regulation.—The nearest dam is at Elizabeth, 6 to 8 miles above; the intermittent operation of the mill at Elizabeth causes a slight daily fluctuation in gage heights.

Accuracy.—Conditions of flow are excellent, except for fluctuations caused by operation of mill at Elizabeth. Backwater from Otter Tail River does not extend to the station, as the range in stage of that stream is small.

The following discharge measurement was made by Hoyt (W. G.) and Soulé, under complete ice cover, December 16, 1911:

Gage height, 5.45 feet; discharge, 6.6 second-feet. Average thickness of ice, 2 feet. Average distance water surface to top of ice, 0.9 foot.

Daily gage height, in feet, of Pelican River near Fergus Falls, Minn., for 1911.

[Henry W. Luther, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.6	.....	5.95	5.68	5.62	5.75	5.44	5.50	5.55	5.95	5.8
2	.....	.....	.....	5.91	5.71	5.74	5.56	5.50	5.40	5.85	5.82	.....
3	5.5	.....	.....	5.95	5.85	5.78	5.72	5.44	5.39	5.90	5.80	.....
4	.....	5.5	6.6	5.80	5.95	5.91	5.49	5.70	5.50	5.68	5.62	.....
5	.....	.....	.....	5.95	5.90	5.80	5.60	5.70	5.40	5.50	5.50	6.2
6	.....	.....	.....	5.88	5.86	5.80	5.45	5.46	5.60	5.70	5.85	.....
7	.....	5.3	7.0	5.80	5.65	5.84	5.55	5.82	5.48	5.71	5.90	.....
8	.....	.....	.....	5.90	5.86	5.75	5.41	5.80	5.48	5.50	5.80	6.0
9	.....	.....	.....	5.60	5.62	6.06	5.44	5.58	5.48	5.70	5.85	.....
10	.....	5.4	6.6	5.70	5.82	5.70	5.38	5.44	5.40	5.70	5.88	.....
11	5.4	.....	.....	5.88	5.82	5.58	5.34	5.48	5.71	5.80	.....	.....
12	.....	.....	.....	5.75	5.92	5.98	5.41	5.65	5.85	5.80	.....	6.1
13	.....	.....	.....	5.68	5.80	5.52	5.31	5.50	5.78	5.80	.....	.....
14	.....	5.2	6.4	5.50	5.49	5.91	5.44	5.42	5.80	5.80	6.4	.....
15	.....	.....	.....	5.50	5.90	5.81	5.31	5.55	5.68	5.50	.....	5.8
16	.....	.....	.....	5.60	5.81	5.62	5.40	5.40	5.85	5.70	.....	5.45
17	.....	.....	.....	5.80	5.92	5.86	5.60	5.71	5.42	5.70	6.20	.....
18	5.2	5.0	6.3	5.90	5.75	5.82	5.66	5.54	5.65	5.90	.....	.....
19	.....	.....	.....	5.85	5.61	5.60	5.52	5.44	5.62	5.50	.....	6.7
20	.....	.....	.....	5.78	5.75	5.75	5.39	5.49	5.68	5.50	.....	.....
21	6.5	5.05	6.0	5.82	5.50	5.50	5.38	5.40	5.70	5.85	6.00	.....
22	.....	.....	.....	5.90	5.60	5.74	5.46	5.70	5.65	5.66	.....	6.8
23	.....	.....	.....	5.50	5.61	5.51	5.40	5.78	5.52	5.98	.....	.....
24	.....	4.9	6.8	5.60	5.52	5.75	5.50	5.65	5.58	6.00	5.70	.....
25	5.5	.....	.....	5.55	5.65	5.60	5.40	5.55	5.56	5.88	.....	.....
26	.....	.....	.....	5.68	5.52	5.50	5.50	5.40	5.59	5.85	.....	.....
27	.....	.....	6.6	5.80	5.60	5.72	5.68	5.41	5.48	5.85	.....	5.9
28	5.3	6.1	.....	5.70	5.68	5.85	5.62	5.50	5.50	5.78	5.60	.....
29	.....	.....	6.10	5.80	5.55	5.50	5.68	5.40	5.60	5.50	.....	6.4
30	.....	.....	6.10	5.69	5.62	5.58	5.42	5.50	5.50	5.82	.....	.....
31	.....	.....	5.85	.....	5.72	.....	5.45	5.40	.....	5.80	.....	.....

NOTE.—Ice present Jan. 1 to Mar. 31 and Nov. 11 to Dec. 31.

Daily discharge, in second-feet, of Pelican River near Fergus Falls, Minn., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	64	28	21	36	6	10	14	64
2	58	31	35	15	10	4	49	45
3	64	49	40	32	6	4	56	42
4	42	64	58	9	30	10	28	21
5	64	56	42	19	30	4	10	10
6	53	50	42	7	8	19	30	49
7	42	24	48	14	45	9	31	56
8	56	50	36	5	42	9	10	42
9	19	21	84	6	17	9	30	49
10	30	45	30	3	6	4	30	53
11	53	45	17	2	9	31	42	.....
12	36	59	70	5	24	49	42	.....
13	28	42	12	1	10	40	42	.....
14	10	9	58	6	5	42	42	.....
15	10	56	43	1	14	28	10	.....
16	19	43	21	4	4	49	36	.....
17	42	59	50	19	31	5	30	.....
18	56	36	45	26	14	24	56	.....
19	49	20	19	12	6	21	10	.....
20	40	36	36	4	9	28	10	.....
21	45	10	10	3	4	30	49	.....
22	56	19	35	8	30	24	26	.....
23	10	20	11	4	40	12	70	.....
24	19	12	36	10	24	17	73	.....
25	14	24	19	4	14	15	53	.....
26	28	12	10	10	4	18	49	.....
27	42	19	32	28	5	9	49	.....
28	30	28	49	21	10	10	40	.....
29	42	14	10	28	4	19	10	.....
30	29	21	17	5	10	10	45	.....
31	.....	32	.....	7	4	.....	42	.....

NOTE.—Daily discharge computed from a well-defined rating curve. Operations of flour mill at Elizabeth, a few miles above, have a decided influence on the flow, especially in winter and during periods of low water. Discharge Jan. 1 to Mar. 31 and Nov. 11 to Dec. 31 estimated, because of ice, from discharge measurements, gage observer's reports, climatologic records, and discharge of adjacent drainage areas. Mean discharge, Nov. 11 to 30, estimated 12 second-feet.

Monthly discharge of Pelican River near Fergus Falls, Minn., for 1911.

[Drainage area. 433 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	[a] 2.0	0.0046	0.005	
February	.....	.....	[a] 2.0	.0046	.005	
March	.....	.....	[a] 10.0	.023	.03	D.
April	64	10	38.3	.088	.09	C.
May	64	9	33.4	.077	.09	B.
June	84	10	34.5	.080	.09	B.
July	36	1	11.4	.026	.03	C.
August	45	4	15.3	.035	.04	C.
September	49	4	18.8	.043	.05	C.
October	73	10	35.7	.082	.09	B.
November	64	.....	22.4	.052	.06	D.
December	.....	.....	[b] 10.0	.023	.03	D.
The year	84	.....	19.5	.045	.61	

[a] Estimated from 1 discharge measurement, semiweekly gage heights, and climatologic records.
[b] Estimated from discharge of Otter Tail River near Fergus Falls, Minn.

NOTE.—See footnotes to table of daily discharge.

WILD RICE RIVER AT TWIN VALLEY, MINN.

Location.—At the highway bridge at Twin Valley, 2 miles above the nearest tributary, which enters at Heiberg.

Records available.—June 30, 1909, to December 31, 1911.

Drainage area.—805 square miles.

Gage.—Vertical staff; datum unchanged since establishment.

Channel.—Practically permanent. The river overflows at a stage of 12 feet on the gage and covers a width of several hundred feet.

Discharge measurements.—From the bridge, except during extreme low water, when measurements are made at a wading section.

Floods.—An exceptionally severe flood occurred in July, 1909, which overflowed the lower part of the valley and wrecked the power dam at Faith by cutting around the end and greatly increasing the width of the channel. The maximum stage of the flood at Twin Valley was 20 feet and the discharge 9,200 second-feet.

Regulation.—There is a dam across the river at Heiberg, but the highest backwater effect is at a point more than a mile below Twin Valley.

Accuracy.—The estimate for the flood discharge above 14 feet made by Kutter's formula in connection with the known area of the cross section and may be somewhat in error, but it is believed this error will not exceed 10 per cent. The remaining estimates are based on a well-defined discharge rating curve and should be reliable.

Discharge measurements of Wild Rice River at Twin Valley, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 19	E. F. Chandler [a]	4.75	51.5
19	do	4.75	54.3
Dec. 19	Goric Monley	5.18	[b] 37.7

[a] June 19, measurement made at wading section.
[b] Dec. 19, measurement made under complete ice cover. Thickness of ice below water surface 0.91 foot.

Daily gage height, in feet, of Wild Rice River at Twin Valley, Minn., for 1911.

[Axel Johnson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	5.3	6.2	5.1	5.7	4.6	4.5	4.6	4.9	.....
2	.....	.....	.....	4.9	6.2	5.1	6.0	4.6	4.5	4.6	4.8	5.0
3	.....	.....	.....	5.1	6.0	5.1	6.0	4.6	4.45	4.6	4.8	.....
4	.....	.....	.....	5.1	6.0	5.1	6.15	4.6	4.45	4.6	4.7	.....
5	.....	.....	.....	5.5	5.9	5.1	6.3	4.6	4.45	4.6	4.6	.....
6	.....	.....	.....	5.5	5.8	5.0	6.15	4.6	4.45	4.6	4.6	.....
7	.....	.....	.....	4.5	5.8	4.95	5.95	4.55	4.5	4.6	4.6	.....
8	.....	.....	.....	5.15	5.7	4.8	5.8	4.5	4.6	4.65	4.7	.....
9	.....	.....	.....	5.15	5.35	4.8	5.65	4.5	4.6	4.65	4.7	5.0
10	.....	.....	.....	5.15	5.3	4.9	5.5	4.5	4.6	4.65	4.7	.....
11	.....	.....	.....	5.3	5.2	4.9	5.8	4.5	4.6	5.15	4.6	.....
12	.....	.....	.....	5.8	5.2	4.9	5.6	4.5	4.55	5.42	4.6	.....
13	.....	5.9	.....	5.9	5.35	4.9	5.35	4.5	4.55	5.52	4.6	.....
14	5.5	.....	6.1	5.78	5.2	4.8	5.15	4.5	4.5	5.5	.....	.....
15	.....	.....	.....	5.55	5.3	4.8	4.9	4.5	4.5	5.55	.....	.....
16	.....	.....	.....	5.8	5.4	4.8	4.7	4.55	4.5	5.5	.....	5.05
17	.....	.....	.....	5.7	6.3	4.8	4.6	4.55	4.5	5.6	.....	.....
18	.....	.....	.....	5.55	6.35	4.75	4.6	5.0	4.5	5.7	5.0	.....
19	.....	.....	.....	5.4	6.05	4.75	4.6	4.85	4.5	5.78	.....	5.18
20	.....	.....	.....	5.75	5.8	4.7	4.6	4.85	4.55	5.7	.....	.....
21	.....	.....	.....	6.45	5.7	4.7	4.6	4.7	4.55	5.65	.....	.....
22	.....	.....	.....	6.6	5.5	5.1	4.6	4.7	4.55	5.6	.....	.....
23	.....	.....	.....	6.65	5.35	5.28	4.65	4.7	4.5	5.55	.....	.....
24	.....	.....	.....	6.52	5.25	5.48	4.6	4.7	4.5	5.55	.....	5.05
25	.....	.....	.....	6.58	5.2	5.6	4.6	4.6	4.5	5.5	5.0	.....
26	.....	.....	.....	6.2	5.1	5.5	4.65	4.5	4.5	5.5	.....	.....
27	.....	5.1	.....	6.0	5.1	4.9	4.65	4.5	4.5	5.35	.....	.....
28	5.7	.....	.....	6.0	5.1	5.6	4.5	4.5	4.6	5.3	.....	.....
29	.....	.....	5.7	6.05	5.05	5.7	4.5	4.5	4.6	5.2	.....	.....
30	.....	.....	.....	6.2	5.0	5.5	4.55	4.5	4.6	5.1	.....	.....
31	.....	.....	.....	.....	5.0	.....	4.55	4.5	.....	5.0	.....	5.0

NOTE.—Ice present Jan. 1 to Mar. 31 (average thickness of ice, about 1.5 feet), and about Nov. 12 to Dec. 31 (average thickness, about 0.8 foot).

Daily discharge, in second-feet, of Wild Rice River at Twin Valley, Minn., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	148	343	110	228	32	23	32	75
2	75	343	110	295	32	23	32	59
3	110	295	110	295	32	20	32	59
4	110	295	110	331	32	20	32	44
5	188	272	110	367	32	20	32	32
6	188	250	92	331	32	20	32	32
7	23	250	84	284	28	23	32	32
8	120	228	59	250	23	32	38	44
9	120	158	59	218	23	32	38	44
10	120	148	75	188	23	32	38	44
11	148	129	75	250	23	32	120	32
12	250	129	75	208	23	28	172	.....
13	272	158	75	158	23	28	192	.....
14	246	129	59	120	23	23	188	.....
15	198	148	59	75	23	23	198	.....
16	250	168	59	44	28	23	188	.....
17	228	367	59	32	28	23	208	.....
18	198	380	52	32	92	23	228	.....
19	168	307	52	32	67	23	246	.....
20	239	250	44	32	67	28	228	.....
21	406	228	44	32	44	28	218	.....
22	445	188	110	32	44	28	208	.....
23	459	158	144	38	44	23	198	.....
24	424	138	184	32	44	23	198	.....
25	440	129	208	32	32	23	188	.....
26	343	110	188	38	23	23	188	.....
27	295	110	75	38	23	23	158	.....
28	295	110	208	23	23	32	148	.....
29	307	101	228	23	23	32	129	.....
30	343	92	188	28	23	32	110	.....
31	.....	92	.....	28	23	.....	92	.....

NOTE.—Daily discharge computed from a rating curve fairly well defined between 23 and 3,400 second-feet. Discharge Nov. 12 to Dec. 31 estimated because of ice from 1 discharge measurement, observer's weekly reports, and climatologic records. Mean discharge Nov. 12 to 30 estimated 25 second-feet. Mean discharge Dec. 1 to 31 estimated 35 second-feet.

Monthly discharge of Wild Rice River at Twin Valley, Minn., for 1911.

[Drainage area, 805 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	22	0.027	0.03	(a)
February	.....	.....	18	.022	.02	(a)
March	.....	.....	70	.087	.10	(a)
April	459	23	239	.297	.33	B.
May	380	92	200	.248	.29	B.
June	228	44	104	.129	.14	B.
July	367	23	133	.165	.19	B.
August	92	23	33.3	.041	.05	C.
September	32	20	25.5	.032	.04	C.
October	246	32	134	.166	.19	B.
November	75	.....	32.4	.040	.04	C.
December	.....	.....	35	.044	.05	D.
The year	459	.....	87.5	.109	1.47	

[a] Estimates of discharge for January, February, and March are very rough and are based on one discharge measurement made in December, 1910, fortnightly gage heights and gage observer's notes.

NOTE.—See footnotes to table of daily discharge.

DEVILS LAKE NEAR DEVILS LAKE, N. DAK.[1]

Location.—At the Chautauqua grounds steamer landing, 6 miles southwest of the city of Devils Lake.

Records available.—June 8, 1901, to September 30, 1911; fragmentary gage heights.

Drainage area.—Theoretically somewhat more than 3,500 square miles; surveys made about 25 years ago showed the lake to be about 35 miles long, the width ranging from 1 to 15 miles and the area being approximately 120 square miles; because of its many bays and slender arms the shore line measures more than 200 miles. The present area of the lake is not given but is estimated at not more than 60 square miles; as the lake has no outlet its size depends entirely on the relations between evaporation from its surface and the rainfall upon it and inflow from the surrounding country.

Gage.—A staff attached to piles of the pier at the steamer landing; read occasionally by E. E. Heerman and J. M. Brannon. The gage zero[2] is 1,416.2 feet above sea level, and 22.90 feet below a standard United States Geological Survey bench-mark post which is set in the bank directly behind the gage and about 8 rods distant.

That the lake level is still being lowered is shown by the following gage heights, those at the close of the season being the lowest ever recorded.

Gage height of Devils Lake, N. Dak., in 1911.

	Feet.		Feet.
July 13	8.50	Aug. 14	8.72
Aug. 4	8.50	Sept. 30	8.46
Aug. 10	8.70		

RED LAKE RIVER AT THIEF RIVER FALLS, MINN.

Location.—One-third mile below the dam at Thief River Falls and a mile or more below the mouth of Thief River.

Records available.—July 2, 1909, to December 31, 1911.

Drainage area.—3,430 square miles.

Gage.—Vertical and inclined staff; datum unchanged since establishment. The gage is read morning and evening and the mean of the two readings is recorded as the mean for the day.

Channel.—Somewhat shifting. The control is also changed temporarily by log jams forming below.

Discharge measurements.—From a car and cable located near the gage.

Winter flow.—The river is frozen over from the latter part of November to the first of April, and measurements are made through the ice to determine the winter flow discharge.

Regulation.—A short distance above is the dam used by the Hansen & Barzen Milling Co. and the city lighting plant. The fluctuating loads on the turbines cause fluctuations in the river stage below the dam. This fluctuation is reduced by the operation of the lighting plant at night, and by the mill, chiefly during the daytime.

Accuracy.—Logs floated down the river may jam below the station and cause backwater. Conditions at this station are not satisfactory and similar conditions exist at all points on the upper river. Therefore the records can not be considered better than fair.

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[1] For description of Devils Lake and all data available from 1867 to 1908 see Water-Supply Paper U. S. Geol. Survey No. 245, pp. 51–54.

[2] In the descriptions of the station published in Water-Supply Paper U. S. Geol. Survey No. 66, p. 14, and No. 85, p. 238, the statement of the elevation of the bench mark above mean sea level was in error.

Discharge measurements of Red Lake River at Thief River Falls, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 5	E. F. Chandler	5.10	[a] 197
June 27	do	3.86	220
28	do	4.00	215
July 20	do	2.92	17.7
Sept. 14	do	3.60	125
Dec. 21	Goric Monley	3.12	[b] 28.6

[a] May 5, log jam 1 mile below.
[b] Dec. 21, measurement under complete ice cover. Average thickness of ice 0.72 foot.

Daily gage height, in feet, of Red Lake River at Thief River Falls, Minn., for 1911.

[Chas. P. Quist, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1				5.40	6.10	5.15	4.07	3.10	3.00	2.55	2.60	
2				5.15	5.45	5.32	3.00	2.50	2.95	2.60	3.15	
3		4.4	4.65	5.45	5.40	5.45	3.85	2.90	2.95	3.40	2.50	
4				5.42	5.50	5.82	3.80	2.80	3.20	2.70	3.05	
5				5.45	5.10	6.05	3.97	3.05	2.90	3.55	2.50	2.5
6				5.38	5.10	5.70	3.82	3.60	3.15	3.30	2.95	
7		4.2	4.7	5.40	4.70	5.35	3.90	2.85	2.95	2.75	2.65	
8				5.35	4.75	7.50	4.00	3.40	3.25	2.70	3.50	3.0
9				5.15	5.12	9.25	3.15	2.85	3.10	2.50	2.90	
10		4.4	4.6	5.45	5.42	7.95	3.70	3.30	2.45	3.60	3.50	
11				6.25	5.55	6.10	3.05	3.15	2.60	2.55	2.50	
12				6.30	5.70	5.50	3.00	3.20	2.70	2.65	2.30	2.5
13	4.4			6.35	5.65	5.20	2.35	2.20	3.00	3.60	2.95	
14		4.6	5.2	5.50	4.72	5.00	2.35	3.20	3.65	2.55	2.30	
15				5.25	5.45	4.70	2.35	3.10	2.80	2.50	2.35	3.0
15				6.00	5.58	4.75	2.20	3.10	3.20	2.70	2.60	
17	4.1	4.6	5.6	4.85	5.80	4.70	2.00	3.40	2.30	3.55	2.40	
18				4.95	5.80	4.50	2.85	3.20	2.60	2.50	2.25	
19				5.10	5.40	4.50	2.40	2.95	3.25	3.60	2.25	3.2
20	4.2			4.75	5.45	4.30	2.95	2.40	2.85	2.75	2.85	
21	4.2	4.7	5.7	5.62	4.70	4.15	3.20	3.25	2.90	3.25	2.45	3.2
22				5.78	5.30	4.00	2.60	3.30	2.70	2.55	2.95	2.6
23				4.90	5.35	4.00	2.45	3.25	2.75	2.65	2.80	
24		4.6	5.8	5.40	5.30	3.90	3.20	2.25	2.45	2.65	2.55	
25				5.40	5.35	2.80	3.15	2.90	3.35	2.60	2.90	
26				5.75	5.50	4.10	2.70	2.25	2.75	2.85	2.55	2.8
27	4.0			5.85	5.50	3.95	2.65	1.75	2.60	2.75	2.95	
28		5.0	5.7	5.95	4.95	3.75	2.70	3.05	2.60	3.55	2.70	4.0
29				6.20	5.65	4.00	2.70	3.15	3.25	2.60	2.70	3.8
30				5.68	5.20	4.15	3.30	3.00	3.45	2.70	2.50	3.8
31	4.4		5.65		5.20		3.05	2.90		2.50		

NOTE.—Prior to June 8 the gage heights were greatly affected by log jams. During the latter half of the year the intermittent operation of the power plant above the station seriously affected the discharge of the river. Ice present Jan. 1 to Mar. 31 and Nov. 11 to Dec. 31.

Daily discharge, in second-feet, of Red Lake River at Thief River Falls, Minn., for 1911.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	350	254	30	20	3.5	4
2	320	20	3	16	4	42
3	450	192	13	16	79	3
4	325	179	8	43	5.5	25
5	340	226	25	13	114	3
6	400	184	129	36	59	16
7	500	206	10	16	6.8	4.8
8	2,070	234	77	51	5.5	102
9	3,820	36	10	30	3	13
10	2,480	153	59	2.5	127	102

Daily discharge, in second-feet, of Red Lake River at Thief River Falls, Minn., for 1911—Continued.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.
11	1,070	25	36	4	3.5	.....
12	770	20	43	5.5	4.8	.....
13	644	1.8	1	20	127	.....
14	565	1.8	43	141	3.5	.....
15	456	1.8	30	8	3	.....
16	474	1	30	43	5.5	.....
17	456	0	77	1.5	114	.....
18	389	10	43	4	3	.....
19	389	2	16	51	127	.....
20	324	16	2	10	6.8	.....
21	278	43	51	13	51	.....
22	234	4	59	5.5	3.5	.....
23	234	2.5	51	6.8	4.8	.....
24	206	43	1.2	2.5	4.8	.....
25	8	36	13	68	4	.....
26	263	5.5	1.2	6.8	10	.....
27	220	4.8	0	4	6.8	.....
28	166	5.5	25	4	114	.....
29	234	5.5	36	51	4	.....
30	278	59	20	87	5.5	.....
31	.....	25	13	.....	3	.....

NOTE.—Owing to backwater from log jams no daily discharge has been computed prior to June 1. June 1 to 7 the discharge has been estimated from a comparison of the Crookston and Red Lake Falls stations. Subsequent to June 7, daily discharge computed from a fairly well defined rating curve. Discharge Jan. 1 to Mar. 31 and Nov. 11 to Dec. 31 estimated, because of ice, from discharge measurements, gage observer's notes, climatologic records, and discharge of adjacent drainage areas.

Mean discharge Nov. 11 to 30 estimated 5 second-feet, varying from about 1 to 14 second-feet.

Mean discharge Dec. 1 to 31 estimated 9 second-feet, varying from about 3 to 30 second-feet.

Monthly discharge of Red Lake River at Thief River Falls, Minn., for 1911.

[Drainage area, 3,430 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a] 125	0.036	0.04	7,690	D.
February	.....	.....	[a] 95	.028	.03	5,280	D.
March	.....	.....	[a] 150	.044	.05	9,220	D.
April	.....	.....	[a] 375	.109	.12	22,300	C.
May	.....	.....	[a] 290	.085	.10	17,800	C.
June	3,820	8	624	.182	.20	37,100	C.
July	254	0	64.4	.019	.02	3,960	B.
August	129	0	30.8	.0090	.01	1,890	B.
September	141	1.5	26.0	.0076	.008	1,550	B.
October	127	3	32.8	.0096	.011	2,020	C.
November	102	.....	13.8	.0040	.005	821	C.
December	.....	.....	9	.0026	.003	553	D.
The year	3,820	0	152	.044	.597	110,000	

[a] Monthly mean discharge January, February, March, April, and May estimated by comparison with records at Red Lake River at Crookston, and Clearwater River at Red Lake Falls.

NOTE.—See footnotes to table of daily discharge.

RED LAKE RIVER AT CROOKSTON, MINN.

Location.—At new highway bridge in Crookston, less than a quarter of a mile below the dam and powerhouse of the Crookston Waterworks, Power & Light Co.; no tributaries within several miles.

Records available.—May 19, 1901, to December 31, 1911.

Drainage area.—5,320 square miles.

Gage.—Until July 1, 1909, the gage was located at the old "Sampson's Addition" bridge, but on that date a chain gage was installed on the new bridge 20 rods below, and set to read the same as the original gage, the datum of which has remained constant since the establishment of the station. In September, 1911, an automatic gage was substituted for the chain gage. A vertical staff nearby reads to the same datum.

Channel.—Slightly changing from year to year.

Discharge measurements.—Made from new bridge.

Winter flow.—At the original section the channel was wholly or partly open throughout the winter, owing to the presence of the dam; at the present section the river freezes entirely across from December to March, and discharge measurements are made through the ice to determine the approximate winter flow.

Accuracy.—The operation of the power plant causes fluctuations in the water surface at the station, but the use of the automatic gage should give excellent results.

Discharge measurements of Red Lake River at Crookston, Minn., 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Mar. 1[a]	Geo. Ebner	3.46	56.8
1[a]	do	4.09	142
Apr. 30	E. F. Chandler	3.73	466
May 6	do	3.59	387
July 19	do	2.46	92.1
Sept. 15[b]	do	2.13	21.9
Nov. 6[b]	do	2.10	14.5
Dec. 18[c]	Goric Monley	2.07	22.5

[a] Mar. 1, measurements made through ice short distance above gage.
[b] Sept. 15 and Nov. 6, measurements made by wading above gage.
[c] Dec. 18, slight ice effect.

Daily gage height, in feet, of Red Lake River at Crookston, Minn., for 1911.

[J. E. Carroll, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.8	3.8	3.8	4.25	3.98	3.75	3.3	2.85	2.40	2.79	2.25	2.57
2	3.8	3.85	3.75	4.30	3.95	3.68	3.05	2.50	2.48	.....	2.30	2.51
3	4.0	3.8	3.8	4.00	3.88	4.25	3.05	2.70	3.25	2.44	2.31	2.94
4	3.95	3.8	3.8	2.90	3.90	3.90	3.10	2.72	2.40	2.49	2.31	2.41
5	4.0	3.85	4.0	4.00	3.78	3.95	2.65	2.77	2.40	2.51	2.75	2.44
6	4.1	3.85	4.0	4.00	3.62	4.11	2.40	2.90	2.40	2.35	2.28	2.46
7	4.0	3.85	4.1	4.00	3.60	4.10	2.30	2.50	2.25	2.38	2.42	2.56
8	4.0	.....	4.3	3.90	3.70	4.15	2.70	2.80	2.30	2.86	2.39	2.56
9	4.0	3.85	3.8	4.00	3.23	6.80	3.05	2.82	2.30	2.16	2.41	2.42
10	4.1	3.9	4.1	4.00	3.45	8.15	3.08	2.52	3.02	2.58	2.47	2.92
11	4.0	3.9	4.75	4.50	3.40	8.10	2.90	2.70	2.28	2.46	2.59	2.44
12	4.0	3.85	4.7	4.50	3.55	7.55	2.60	2.45	2.60	2.48	2.40	2.48
13	4.1	3.8	4.7	4.40	3.70	6.84	2.90	2.40	2.43	2.42	2.42	2.54
14	4.15	3.8	4.75	4.40	3.20	5.60	2.80	2.60	2.52	2.48	2.44	2.54
15	4.0	3.8	4.7	4.50	4.05	5.28	2.60	2.75	2.32	2.72	2.44	2.58
16	3.55	3.75	4.7	4.55	4.18	4.63	2.60	2.72	2.35	2.32	2.43	2.50
17	3.5	3.8	4.8	4.50	3.45	4.85	2.40	2.65	2.25	2.44	2.46	2.86
18	3.6	3.8	5.4	4.50	3.55	4.60	2.60	2.43	2.30	2.49	2.49	2.45
19	3.75	3.8	4.75	4.45	3.60	4.70	2.60	2.42	2.48	2.58	2.32	2.47
20	3.7	3.75	4.75	4.20	3.90	3.85	2.60	2.55	2.40	2.55	2.51	2.58
21	3.65	3.65	4.7	4.18	3.80	3.90	2.60	2.50	2.40	2.50	2.42	2.64
22	.....	3.6	4.65	4.05	3.88	4.00	2.62	2.42	2.45	2.73	2.32	2.60
23	3.85	3.7	4.65	4.40	3.97	3.35	2.65	2.35	2.28	2.40	2.29	2.47
24	4.05	3.7	4.7	3.95	3.70	3.70	2.68	2.42	2.60	2.58	2.37	2.75
25	4.0	3.85	4.8	3.90	3.52	2.80	2.62	2.55	2.25	2.53	2.43	2.62
26	3.85	3.8	4.75	3.78	3.60	3.72	2.45	2.45	2.48	2.51	2.86	2.82
27	3.9	4.0	4.75	3.90	3.85	3.15	2.42	2.42	2.29	2.51	2.18	2.75
28	3.8	4.5	5.1	4.50	3.70	3.15	2.42	2.40	2.36	2.56	2.47	2.67
29	3.8	.....	5.0	4.05	3.60	3.30	2.45	2.40	2.35	2.74	2.57	2.72
30	3.85	.....	4.7	3.80	3.75	3.05	2.45	2.45	2.35	2.45	2.54	2.63
31	3.85	.....	4.3	.....	3.70	.....	2.95	2.40	.....	2.40	.....	2.97

NOTE.—Relation of gage height to discharge affected by ice about Jan. 1 to Mar. 23 and Nov. 11 to Dec. 31.

Daily discharge, in second-feet, of Red Lake River at Crookston, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	685	561	465	304	178	72	162	44
2	.....	710	548	437	231	93	89	120	52
3	.....	570	519	685	231	140	289	80	54
4	.....	527	527	527	245	145	72	91	54
5	.....	570	477	548	128	158	72	95	152
6	.....	570	414	646	72	191	72	62	49
7	.....	570	406	615	52	93	44	68	76
8	.....	527	445	638	140	165	52	181	70
9	.....	570	283	2,320	231	170	52	29	74
10	.....	570	353	3,380	239	98	223	111	87
11	.....	815	336	3,340	191	140	49	85	.....
12	.....	815	388	2,900	116	82	116	89	.....
13	.....	760	445	2,350	191	72	78	76	.....
14	.....	760	274	1,400	165	116	98	89	.....
15	.....	815	592	1,270	116	152	56	145	.....
16	.....	842	651	886	116	145	62	56	.....
17	.....	815	359	1,010	72	128	44	80	.....
18	.....	815	388	870	116	78	52	91	.....
19	.....	788	406	925	116	76	89	111	.....
20	.....	660	527	506	116	104	72	104	.....
21	.....	651	485	527	116	93	72	93	.....
22	.....	592	519	570	121	76	82	148	.....
23	.....	760	557	320	128	62	49	72	.....
24	925	548	445	445	135	76	116	111	.....
25	980	527	377	165	121	104	44	100	.....
26	952	477	406	453	82	82	89	95	.....
27	952	527	506	260	76	76	50	95	.....
28	1,160	815	445	260	76	72	64	107	.....
29	1,100	592	406	304	82	72	62	150	.....
30	925	485	465	231	82	82	62	82	.....
31	710	.....	445	.....	204	72	.....	72	.....

NOTE.—Daily discharge computed from a rating curve well defined between discharges 10 and 570 second-feet (gage heights 2 and 4 feet), and fairly well defined above discharge 570 second-feet. Discharge Jan. 1 to Mar. 23 and Nov. 11 to Dec. 31 estimated, because of ice, from discharge measurements, gage heights, and climatologic records. Mean discharge Jan. 1 to 31 estimated 150 second-feet, varying from about 70 to 190 second-feet. Mean discharge Feb. 1 to 28 estimated 120 second-feet, varying from about 60 to 270 second-feet. Mean discharge Mar. 1 to 23 estimated 250 second-feet, varying from about 90 to 850 second-feet. Mean discharge Nov. 11 to 30 estimated 60 second-feet, varying from about 30 to 180 second-feet. Mean discharge Dec. 1 to 31 estimated 80 second-feet, varying from about 40 to 190 second-feet. Discharge Oct. 2, interpolated.

Monthly discharge of Red Lake River at Crookston, Minn., for 1911.

[Drainage area, 5,320 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	150	0.028	0.03	9,220	D.
February	.....	.....	120	.023	.02	6,660	D.
March	1,160	.....	434	.082	.09	26,700	C.
April	842	477	658	.124	.14	39,200	B.
May	651	274	450	.085	.10	27,700	B.
June	3,380	165	977	.184	.21	58,100	B.
July	304	52	142	.027	.03	8,730	B.
August	191	62	109	.020	.02	6,700	B.
September	289	44	81.4	.015	.02	4,840	B.
October	162	29	98.4	.018	.02	6,050	B.
November	.....	.....	63.7	.012	.01	3,790	C.
December	.....	.....	80	.015	.02	4,920	D.
The year	3,380	.....	280	.053	.71	203,000	

NOTE.—See footnotes to tables of daily gage height and daily discharge.

THIEF RIVER NEAR THIEF RIVER FALLS, MINN.

Location.—At the Drybrooke ford, 6 miles north of Thief River Falls, in sec. 3, T. 154 N., R. 43 W. The nearest tributary is the outlet of Mud Lake which enters Thief River in the northeastern part of T. 156 N., R. 42 W.

Records available.—July 1, 1909, to December 31, 1911.

Drainage area.—1,010 square miles.

Gage.—Inclined staff; datum unchanged since establishment. When this inclined staff gage was installed on August 19, 1909, its reading (6.36 feet) was made to agree with that of the temporary vertical staff gage which had been used from July 1 to August 18, 1909. On June 29, 1911, and September 18, 1912 (before the publication of this report) it was found by wye levels that the gage was in error, the amounts being the same—probably the result of a mistake in graduating or setting the gage at the time of its installation. Assuming the 6.4 point to be correct, the results of the levels are as follows:

Inclined-rod gage readings	5.2	6.0	7.0	8.0	9.0	10.0	11.0
True elevations	5.28	6.03	6.96	7.90	8.85	9.80	10.75

As the whole record at this station (except July 1 to Aug. 18, 1909) is referred to this inclined-rod gage and is therefore consistent in itself, no correction has been made in published gage heights because of the above discrepancy.

Channel.—Practically permanent.

Discharge measurements.—Made by means of a boat and cable a short distance below the gage.

Winter flow.—From the middle of November to the first of April the river is entirely frozen over, and discharge measurements are made to determine the winter discharge.

Regulation.—The dam at Thief River Falls, at the mouth of Thief River, backs up the water in Thief River for several miles, but the station is protected by the rapids below from the influence of the dam. During 1910 and 1911 drainage work has been carried on extensively in Thief River Basin and the effect will be to modify the regimen of the river. The extremely low flow of 1910 and 1911 was due partly to the holding back of the run-off by temporary dams for use of the floating dredges above the station.

Accuracy.—See remarks under "Gage" above.

The following discharge measurement was made by E. F. Chandler:

June 29, 1911: Gage height, 3.82 feet; discharge, 3.0 second-feet; velocity observations made with floats.

Daily gage height, in feet, of Thief River near Thief River Falls, Minn., for 1911.

[H. J. Maland, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.20	5.08	3.61	3.57	3.25	3.2	3.4	.....	.....
2	.....	4.19	4.44	3.65	3.56	3.2	3.2	3.4	.....	.....
3	.....	4.32	4.11	3.75	3.48	3.2	3.2	3.42	.....	.....
4	.....	4.34	4.05	3.94	3.85	3.2	3.25	3.46	.....	.....
5	.....	4.30	4.00	4.04	4.10	3.2	3.2	3.48	3.4	.....
6	.....	4.18	3.90	3.83	3.85	3.2	3.2	3.55	.....	.....
7	.....	4.20	3.89	3.73	3.83	3.2	3.2	3.55	.....	.....
8	.....	4.25	4.11	4.35	3.73	3.2	3.2	3.55	.....	.....
9	.....	4.22	3.87	4.20	3.66	3.2	3.2	3.48	.....	.....
10	.....	4.38	3.87	4.42	3.57	3.2	3.2	3.45	.....	.....
11	.....	4.53	4.04	4.24	3.48	3.2	3.2	3.45	.....	.....
12	.....	4.53	4.05	4.05	3.42	3.2	3.2	3.45	.....	.....
13	.....	5.08	4.01	3.87	3.40	3.2	3.25	3.45	.....	.....
14	.....	4.57	3.91	3.79	3.38	3.42	3.2	3.45	.....	3.2
15	.....	4.86	3.85	3.75	3.38	3.4	3.2	3.45	.....	.....

Daily gage height, in feet, of Thief River near Thief River Falls, Minn., for 1911—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	4.15	4.90	3.81	3.75	3.38	3.38	3.2	3.45	.....	.....
17	4.15	4.75	3.76	4.21	3.35	3.35	3.2	3.45	.....	.....
18	4.0	4.64	3.74	4.55	3.32	3.35	3.2	3.45	.....	.....
19	3.85	4.55	3.73	4.60	3.30	3.32	3.6	3.42	.....	.....
20	4.0	4.50	3.69	4.42	3.25	3.30	3.57	3.42	.....	3.2
21	4.25	4.41	3.61	4.31	3.25	3.30	3.48	3.42	.....	.....
22	4.55	4.60	3.59	4.22	3.25	3.2	3.45	3.42	.....	.....
23	4.55	4.76	3.57	4.19	3.35	3.2	3.42	3.42	.....	.....
24	4.5	5.04	3.66	4.15	3.3	3.2	3.42	3.42	.....	.....
25	4.87	5.26	3.55	4.15	3.25	3.2	3.42	3.4	.....	.....
26	5.05	5.32	3.63	4.12	3.25	3.2	3.42	3.4	.....	.....
27	4.50	5.32	3.56	4.02	3.25	3.35	3.4	3.4	3.2	
28	4.6	5.20	3.56	3.87	3.25	3.32	3.4	3.4	.....	.....
29	4.3	5.14	3.42	3.69	3.25	3.3	3.42	3.4	.....	.....
30	4.22	5.20	3.48	3.65	3.25	3.3	3.42	3.4	.....	.....
31	4.14	.....	3.6	.....	3.25	.....	.....	3.42	.....	.....

NOTE.—Gage heights July 25 to Aug. 13, Aug. 22 to 26, Sept. 1 to 19, and Nov. 27 to Dec. 31, 1911, estimated because water surface was below gage. Where 3.40 is recorded, the observer reported "3.40 or below." The observer reported no flow past the gage Jan. 1 to Mar. 15, July 25 to Aug. 13, Aug. 22 to 26, and about Nov. 10 to Dec. 31, 1911.

Daily discharge, in second-feet, of Thief River near Thief River Falls, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	12	82	2.1	1.8	0.2	0.0	0.9	0.9
2	.....	12	24	2.4	1.8	.0	.0	.9	.8
3	.....	18	8.0	3.1	1.3	.0	.0	1.0	.7
4	.....	19	6.5	4.8	4.0	.0	.2	1.2	.6
5	.....	17	5.5	6.3	7.5	.0	.0	1.3	.6
6	.....	11	4.4	3.8	4.0	.0	.0	1.7	.6
7	.....	12	4.3	2.9	3.8	.0	.0	1.7	.5
8	.....	14	8.0	20	2.9	.0	.0	1.7	.4
9	.....	13	4.1	12	2.4	.0	.0	1.3	.3
10	.....	21	4.1	23	1.8	.0	.0	1.2	.....
11	.....	30	6.3	11	1.3	.0	.0	1.2	.....
12	.....	30	6.5	8.5	1.0	.0	.0	1.2	.....
13	.....	82	5.7	4.1	.9	.0	.2	1.2	.....
14	.....	33	4.5	3.4	.8	1.0	.0	1.2	.....
15	.....	57	4.0	3.1	.8	.9	.0	1.2	.....
16	.....	61	3.6	3.1	.8	.8	.0	1.2	.....
17	.....	47	3.2	12	.6	.6	.0	1.2	.....
18	5.5	38	3.0	32	.5	.6	.0	1.2	.....
19	4.0	32	2.9	35	.4	.5	2.0	1.0	.....
20	5.5	28	2.6	23	.2	.4	1.8	1.0	.....
21	14	23	2.1	18	.2	.4	1.3	1.0	.....
22	32	35	1.9	13	.2	.0	1.2	1.0	.....
23	32	48	1.8	12	.6	.0	1.0	1.0	.....
24	28	77	2.4	9.8	.4	.0	1.0	1.0	.....
25	58	105	1.7	9.8	.2	.0	1.0	.9	.....
26	78	114	2.2	8.4	.2	.0	1.0	.9	.....
27	28	114	1.8	5.9	.2	.6	.9	.9	.....
28	35	97	1.8	4.1	.2	.5	.9	.9	.....
29	17	89	1.0	2.6	.2	.4	1.0	.9	.....
30	13	97	1.3	2.4	.2	.4	1.0	.9	.....
31	9.3	.....	2.0	.....	.2	.2	.....	1.0	.....

NOTE.—Discharge Jan. 1 to Mar. 17 and Nov. 1 to Dec. 31 estimated, because of ice, from observer's notes and climatologic records. No flow from Jan. 1 to Mar. 12. Discharge Mar. 13 to 17 estimated 4 second-feet varying from about 1 to 9 second-feet. Nov. 10 to Dec. 31 no flow. Where no flow is noted the discharge is estimated to have been less than 0.1 second-feet.

Monthly discharge of Thief River near Thief River Falls, Minn., for 1911.

[Drainage area, 1,010 square miles.]

Month	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January			0	0.000	0.00	
February			0	.000	.00	
March	78		12.2	.012	.01	C.
April	114	11	46.2	.046	.05	B.
May	82	1.0	6.88	.0068	.008	C.
June	35	2.1	10.1	.010	.01	B.
July	7.5	.2	1.34	.0013	.001	C.
August	1.0	.0	.24	.00024	.0003	D.
September	2.0	.0	.48	.00048	.0005	D.
October	1.7	.9	1.13	.0011	.001	C.
November	.9		.18	.00018	.0002	D.
December			0	.000	.00	
The year	114	0	6.53	.0065	.08	

NOTE.—See footnote to table of daily discharge.

CLEARWATER RIVER AT RED LAKE FALLS, MINN.

Location.—At Great Northern Railway Bridge at Red Lake Falls, Minn., about 1½ miles above the mouth of the river and 2 miles below the nearest tributary.

Records available.—June 18, 1909, to December 31, 1911.

Drainage area.—1,310 square miles.

Gage.—Vertical staff, about half a mile farther down stream than the original gage. It was placed September 12, 1911, on account of the building of a dam which will cause several feet of backwater at the original section. The new gage was set to read 2.23 feet when the original gage read 5.83 feet. Readings to October 31, 1911, have been taken from the original gage and estimates of discharge based thereon. Simultaneous records were maintained from September 12 to October 31.

Channel.—Practically permanent.

Discharge measurements.—Made from the railroad bridge or by wading.

Winter flow.—The river is frozen over from the middle of November to the first of April. Measurements are made through the ice to determine the winter discharge.

Accuracy.—As conditions at this station are good, the records should be reliable. It is possible that backwater from the Healy dam on Red Lake River may slightly affect the relation of gage height to discharge at this new location if flashboards of usual height be put in place at the Healy dam.

Discharge measurements of Clearwater River at Red Lake Falls, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
July 29[a]	E. F. Chandler	5.60	26.1
Sept. 13[a]	do	[b] 2.23	80
Dec. 20[c]	Goric Monley	2.11	65

[a] Measurement made by wading.
[b] Old gage read 5.83.
[c] Measurement made under complete ice cover. Average thickness of ice 1.35 feet.

NOTE.—The measurements of Sept. 13 and Dec. 20 refer to the new gage.

Daily gage height, in feet, of Clearwater River at Red Lake Falls, Minn., for 1911.

Old gage.

[James Benoit, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1		7.05			6.05	6.00	5.54	5.90	5.88	5.84
2					6.00	6.02	5.54	6.02	5.82	5.80
3					6.05	6.10	5.40	5.95	5.80	5.84
4	7.0				5.92	6.50	5.00	5.90	5.80	5.86
5				7.9	5.88	6.52	5.30	5.90	5.80	5.80
6					5.80	6.38	5.38	5.95	5.78	5.80
7		7.02			5.81	6.32	5.40	6.15	5.75	5.84
8			7.22		5.82	6.85	5.50	6.12	5.70	5.89
9				7.88	5.74	7.80	5.56	6.00	5.70	5.84
10				7.81	5.60	7.75	5.62	5.82	5.75	5.80
11	7.1			7.78	6.92	7.55	5.60	5.75	5.75	5.91
12				7.56	6.88	7.35	5.45	5.80	5.88	5.81
13				7.45	6.68	7.16	5.45	5.78	5.98	5.80
14				7.24	6.55	6.95	5.48	5.78	5.94	5.81
15		7.05	7.3	6.89	6.40	6.81	5.50	5.80	5.82	5.82
16				6.85	6.25	6.65	5.52	5.82	5.80	5.89
17				6.92	6.29	6.51	5.55	5.85	5.80	5.94
18	7.12			6.76	6.30	6.42	5.60	5.90	5.85	5.90
19				6.55	6.26	6.30	5.60	5.95	5.82	5.91
20				6.42	6.20	6.22	5.52	6.00	5.78	5.91
21		7.15		6.38	6.28	6.10	5.60	6.10	5.72	5.89
22			7.6	6.31	6.29	6.05	5.60	6.20	5.70	5.80
23				6.30	6.20	5.96	5.65	6.20	5.70	5.65
24				6.31	6.22	5.97	5.70	6.20	5.75	5.62
25	7.1			6.32	6.15	5.88	5.65	6.30	5.80	5.64
26				6.29	6.12	5.92	5.50	6.35	5.85	5.66
27				6.20	6.08	5.98	5.60	6.30	5.92	5.70
28		7.1		6.12	6.00	6.00	5.72	6.40	6.00	5.74
29				6.10	6.01	5.79	5.80	6.25	5.95	5.79
30				6.12	6.12	5.55	5.85	6.15	5.85	5.88
31					6.08		5.90	6.05		5.82

NOTE.—Ice present Jan. 1 to Apr. 8. Average thickness of ice 2 to 2.5 feet.
July 4, gage height apparently in error.

New gage.

[Leo Steinert, observer.]

Day.	Sept.	Oct.	Nov.	Day.	Sept.	Oct.	Nov.	Day.	Sept.	Oct.	Nov.
1		2.1	2.05	11		2.2	2.42	21	2.15	2.2	
2		2.2	2.3	12	2.1	2.2		22	2.2	2.4	
3		2.25	2.65	13	2.18	2.2		23	2.2	2.05	
4		2.25	2.2	14	2.15	2.22		24	2.2	2.2	
5		2.25	2.15	15	2.05	2.3		25	2.2	2.25	
6		2.25	2.22	16	2.15	2.3		26	2.2	2.2	
7		2.3	2.22	17	2.2	2.3		27	2.2	2.3	
8		2.2	2.25	18	2.05	2.38		28	2.2	2.3	
9		2.25	2.3	19	2.2	2.05		29	2.2	2.25	
10		2.25	2.3	20	2.2	2.2		30	2.2	2.3	
								31		2.3	

NOTE.—Relation of gage height to discharge affected by ice about Nov. 10 to Dec. 31, 1911.

Daily discharge, in second-feet, of Clearwater River at Red Lake Falls, Minn., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1....	60	68	63	30	53	51	48	16....	234	95	178	30	46	44	52
2....	70	63	65	30	65	46	44	17....	257	101	146	30	48	44	57
3....	80	68	74	27	58	44	48	18....	207	103	126	32	53	48	53
4....	100	55	144	20	53	44	49	19....	155	97	103	32	58	46	54
5....	125	51	148	26	53	44	44	20....	126	87	90	30	63	43	54
6....	175	44	118	27	58	43	44	21....	118	100	74	32	74	38	52
7....	250	45	107	27	80	40	48	22....	105	101	68	32	87	37	44
8....	400	46	234	29	77	37	52	23....	103	87	59	34	87	37	34
9....	767	40	715	31	63	37	48	24....	105	90	60	37	87	40	33
10....	722	32	685	33	46	40	44	25....	107	80	51	34	103	44	34
11....	703	257	565	32	40	40	54	26....	101	77	55	29	112	48	35
12....	571	244	448	28	44	51	45	27....	87	72	61	32	103	55	37
13....	505	185	352	28	43	61	44	28....	77	63	63	38	122	63	40
14....	390	155	268	29	43	57	45	29....	74	64	43	44	95	58	43
15....	247	122	221	29	44	46	46	30....	77	77	30	48	80	48	51
								31....	.....	72	.....	53	68	.....	46

NOTE.—Daily discharge computed from a well-defined rating curve and gage heights read from original gage. Discharge estimated from Apr. 1 to 8 because of ice. Discharge estimated July 4 because of apparent error in gage height.

Monthly discharge of Clearwater River at Red Lake Falls, Minn., for 1911.

[Drainage area, 1,310 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a] 45.0	0.034	0.04	2,770	C.
February	.....	.....	[a] 45.0	.034	.04	2,500	D.
March	.....	.....	[a] 55.0	.042	.05	3,380	D.
April	767	60	237	.181	.20	14,100	B.
May	257	32	91.6	.070	.08	5,630	A.
June	715	30	180	.137	.15	10,700	A.
July	53	[b] 20	32.0	.024	.03	1,970	B.
August	122	40	67.9	.052	.06	4,180	C.
September	63	37	45.8	.035	.04	2,730	C.
October	57	33	45.9	.035	.04	2,820	C.
The period	.....	.....	.....	.....	.....	50,800	

[a] Estimated from one discharge measurement, semiweekly gage heights to the water surface, and climatologic records.
[b] Estimated.

NOTE.—See footnotes to table of daily discharge.

SOUTH BRANCH OF TWO RIVERS AT HALLOCK, MINN.

Location.—At private wagon bridge on farm of John Ross, in section 12, T. 161 N., R. 49 W., half a mile north of Hallock, a mile below the nearest tributary, a small creek entering from the west.

Records available.—April 29 to November 15, 1911.

Drainage area.—776 square miles.

Gage.—Vertical staff.

Channel.—Probably permanent, as the control point is an abandoned loose-rock dam 4 feet high, a mile or more below the station. The dam was formerly used to raise the water level for a railroad water tank.

Discharge measurements.—Made from the bridge.

Winter flow.—From November to April the river is frozen over and gage readings are discontinued.

Accuracy.—Low because of doubt as to accuracy of daily gage heights in addition to discharge rating curve only fairly well defined.

Discharge measurements of South Branch of Two Rivers at Hallock, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Apr. 29	E. F. Chandler	2.21	30.0
June 15	do	7.72	540
26	do	4.32	178
Oct. 23	Gorie Monley	1.80	9.2

Daily gage height, in feet, of South Branch of Two Rivers at Hallock, Minn., for 1911.

[John A. Ross, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.10	2.40	3.0	1.6	1.8	2.0	2.0
2	.....	2.00	2.50	3.0	1.6	1.8	2.0	2.0
3	.....	1.90	2.60	2.9	1.6	1.8	2.0	2.0
4	.....	1.90	4.10	2.8	1.6	1.8	2.6	2.0
5	.....	1.90	4.60	2.6	1.6	1.8	2.6	1.9
6	.....	1.90	4.50	2.6	1.8	1.7	3.0	1.9
7	.....	1.90	4.50	2.4	1.8	1.7	3.0	1.9
8	.....	1.90	5.50	2.4	1.8	1.6	3.0	1.9
9	.....	1.80	7.30	2.4	1.6	1.6	2.9	1.9
10	.....	1.90	8.30	2.4	1.6	1.6	2.9	1.9
11	.....	2.50	8.60	2.4	1.6	1.6	2.6	.....
12	.....	2.65	8.60	2.2	1.6	1.6	2.6	.....
13	.....	2.85	8.60	2.2	1.6	1.6	2.9	.....
14	.....	3.10	8.10	2.2	1.6	1.6	3.0	.....
15	.....	3.30	7.70	2.1	1.6	1.6	3.0	.....
16	.....	3.38	7.00	2.1	1.6	1.6	2.9	.....
17	.....	3.30	7.40	2.1	1.6	1.6	2.9	.....
18	.....	3.35	7.40	2.0	1.6	1.9	2.6	.....
19	.....	3.20	7.00	2.0	1.6	2.0	2.6	.....
20	.....	3.40	6.60	2.0	1.6	2.0	2.3	.....
21	.....	3.50	6.30	2.0	1.6	1.9	2.0	.....
22	.....	2.90	6.00	1.9	1.8	1.9	2.0	.....
23	.....	2.60	5.60	1.8	1.8	1.7	2.0	.....
24	.....	2.70	5.00	1.8	1.9	1.7	2.0	.....
25	.....	2.60	4.70	1.8	2.0	1.7	2.0	.....
26	.....	2.50	4.50	1.6	2.0	1.7	2.0	.....
27	.....	2.30	4.00	1.6	1.8	1.7	2.0	.....
28	.....	2.20	3.50	1.6	1.8	2.0	2.0	.....
29	2.2	2.20	3.20	1.6	1.8	2.0	2.0	.....
30	2.15	2.30	3.00	1.6	1.8	2.0	2.0	.....
31	.....	2.30	.....	1.6	1.8	.....	2.0	.....

Daily discharge, in second-feet, of South Branch of Two Rivers at Hallock, Minn., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	24	39	76	8	13	20	20
2	.....	20	45	76	8	13	20	20
3	.....	16	51	69	8	13	20	20
4	.....	16	161	63	8	13	51	20
5	.....	16	206	51	8	13	51	16
6	.....	16	197	51	13	10	76	16
7	.....	16	197	39	13	10	76	16
8	.....	16	295	39	13	8	76	16
9	.....	13	491	39	8	8	69	16
10	.....	16	601	39	8	8	69	16

Daily discharge, in second-feet, of South Branch of Two Rivers at Hallock, Minn., for 1911—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
11	.....	45	634	39	8	8	51	.....
12	.....	54	634	29	8	8	51	.....
13	.....	66	634	29	8	8	69	.....
14	.....	83	579	29	8	8	76	.....
15	.....	97	535	24	8	8	76	.....
16	.....	103	458	24	8	8	69	.....
17	.....	97	502	24	8	8	69	.....
18	.....	100	502	20	8	16	51	.....
19	.....	90	458	20	8	20	51	.....
20	.....	104	414	20	8	20	34	.....
21	.....	112	381	20	8	16	20	.....
22	.....	69	348	16	13	16	20	.....
23	.....	51	305	13	13	10	20	.....
24	.....	57	245	13	16	10	20	.....
25	.....	51	215	13	20	10	20	.....
26	.....	45	197	8	20	10	20	.....
27	.....	34	152	8	13	10	20	.....
28	.....	29	112	8	13	20	20	.....
29	29	29	90	8	13	20	20	.....
30	26	34	76	8	13	20	20	.....
31	.....	34	.....	8	13	.....	20	.....

NOTE.—Daily discharge computed from a rating curve fairly well defined between 6 and 568 second-feet (gage heights 1.5 and 8.0 feet). Discharge Nov. 11 to Dec. 31 estimated by Prof. E. F. Chandler from climatologic records, discharge of adjacent drainage areas, one discharge measurement (made Mar. 12, 1912, before the preparation of this report) and the fact that the observer kept watch of the stream in order to report any marked variation in discharge. It should be noted that these estimates are based on less data than estimates at most of the stations in this report and that they simply represent the best values available for publication. Mean discharge Nov. 11 to 30 estimated 10 second-feet. Mean discharge Dec. 1 to 31 estimated 8 second-feet.

Monthly discharge of South Branch of Two Rivers at Hallock, Minn., for 1911.

[Drainage area, 776 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
May	112	13	50.1	0.065	0.07	B.
June	634	39	325	.419	.47	B.
July	76	8	29.8	.038	.04	D.
August	20	8	10.6	.014	.02	D.
September	20	8	12.1	.016	.02	D.
October	76	20	43.4	.056	.06	D.
November	20	.....	12.5	.016	.02	D.
December	.....	.....	8.0	.010	.01	

NOTE.—See footnotes to table of daily discharge.

PEMBINA RIVER AT NECHE, N. DAK.

Location.—At the highway bridge 20 rods east of the Great Northern Railway bridge, two-thirds of a mile north of Neche, N. Dak.

Records available.—April 29, 1903, to December 31, 1911.

Drainage area.—2,940 square miles.

Gage.—Vertical staff in two sections for medium and low stage, attached to the abutment and a piling under the bridge, at the north end of the highway bridge. This gage was installed July 31, 1911. The original gage, which can be read at medium and high stage, is a vertical staff attached to the abutment of the railway bridge. The zeros of the two gages are at the same elevation, this elevation having been unchanged since the first establishment; at low stage the slope of the water surface between the bridges is inappreciable; at highest stage the readings at the railway bridge would probably be from 0.03 to 0.06 foot greater than at the highway bridge.

Channel.—Clay and silt; slightly shifting.

Discharge measurements.—From the highway bridge. At very low stage made by wading below the Great Northern dam.

Regulation.—The water is raised at low stage from 1 to 2 feet at the gage by a loose-rock dam about 3 feet high one-third mile below, constructed to give sufficient depth of water for the intake of the Great Northern Railway water tank. There is considerable leakage through the dam, but no permanent determination of the effect of this dam can be made because it is liable to be changed by ice run or spring flood in any year. There are no reservoirs or power plants that affect the flow.

Winter flow.—The ordinary winter discharge is less than the leakage through the dam; hence, estimates can not be made from gage observations without numerous discharge measurements.

Accuracy.—On account of the varying effect at low stage of the dam, the records are not considered better than fair.

Discharge measurements of Pembina River at Neche, N. Dak., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
May 30	E. F. Chandler	2.79	148
July 31	do	1.77	15.7
Oct. 1	Goric Monley	1.70	9.4

NOTE.—Measurements of July 31 and Oct. 1 were made by wading at a section below the Great Northern Railway's dam.

Daily gage height, in feet, of Pembina River at Neche, N. Dak., for 1911.

[W. Young and E. Young, observers.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1		4.3	3.2	2.7			1.7	1.4
2		4.0	3.3	2.7			1.7	1.4
3		4.0	3.4	2.8			1.7	1.5
4		4.0	3.0	2.8		1.9	1.7	1.7
5		3.9	3.0	2.7		1.9	1.8	1.9
6		3.7	3.1	2.7		1.9	1.7	1.9
7		3.7	3.2	2.7		2.0	1.7	1.9
8		3.6	3.3	2.8		2.0	1.8	1.8
9		3.5	3.4	2.9		2.0	1.7	1.8
10		3.2	3.3	3.0		1.9	1.6	1.9
11		3.1	3.3	3.0		1.9	1.5	1.9
12		3.0	3.0	2.8		2.0	1.5	1.9
13		3.4	3.0	2.9		2.0	1.4	1.9
14		3.8	3.0	3.0		1.9	1.4	1.9
15		3.6	3.1	3.1		1.9	1.3	1.9
16		3.3	3.4	2.9		1.9	1.3	1.9
17		4.0	4.6	3.0		1.9	1.4	1.9
18		4.3	4.8	2.8		1.9	1.3	1.9
19		3.8	4.5	2.8		1.9	1.3	1.9
20		3.5	3.8	2.8		1.9	1.4	2.0
21		3.2	3.1	2.7		1.9	1.3	2.0
22		3.2	3.3	2.9		2.0	1.3	1.9
23	8.4	3.2	3.0	3.0		1.9	1.3	1.9
24	8.9	3.0	2.9	3.0		1.9	1.3	1.9
25	8.6	3.6	2.7	2.9		1.8	1.4	1.8
26	8.2	3.8	3.0	2.8		1.8	1.4	1.8
27	5.8	3.2	3.1	2.7		1.8	1.5	1.7
28	5.0	3.6	3.0	2.7		1.8	1.5	1.7
29		4.0	2.9	2.7		1.8	1.7	1.7
30		4.3	2.9	2.6		1.8		1.6
31	4.8		2.8			1.7		1.7

NOTE.—The new observer, Elsie Young, began reading the gage on May 21. From July 1 to Aug. 3 the river was below the top of the cofferdam around the railway bridge pier, to which the old gage is attached, and the gage heights reported by observer represented the level of the water in a pool inside the cofferdam and not the height of the river proper and are therefore not published. The observer notes that from Aug. 4 on she read the gage at the highway bridge. Relation of gage height to discharge probably affected by ice Mar. 23 to 30. River reported "frozen" Mar. 29 and 30.

Daily discharge, in second-feet, of Pembina River at Neche, N. Dak., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	420	215	133	110	15	11	2
2	.....	363	233	133	110	15	11	2
3	.....	363	251	149	100	20	11	4
4	.....	363	181	149	100	25	11	11
5	.....	344	181	133	90	25	17	25
6	.....	306	198	133	90	25	11	25
7	.....	306	215	133	80	35	11	25
8	.....	28[illegible]	233	149	70	35	17	17
9	.....	269	251	165	70	35	11	17
0	.....	215	233	181	60	25	7	25
1	.....	198	233	181	60	25	4	25
2	.....	181	181	149	50	35	4	25
3	.....	251	181	165	50	35	2	25
4	.....	325	181	1[illegible]	40	25	2	25
5	.....	287	198	198	40	25	1	25
6	.....	233	251	165	40	25	1	25
7	.....	363	480	181	35	25	2	25
8	.....	420	520	149	35	25	1	25
9	.....	325	460	149	35	25	1	25
0	.....	269	325	149	30	25	2	35
1	.....	215	198	133	30	25	1	35
2	.....	215	233	165	25	35	1	25
3	800	215	181	181	25	25	1	25
4	900	181	165	181	25	25	1	25
5	900	287	133	165	20	17	2	17
6	800	325	181	149	20	17	2	17
7	500	215	198	133	20	17	4	11
8	450	287	181	133	20	17	4	11
9	450	363	165	133	15	17	11	11
0	450	420	165	118	15	17	7	7
1	520	.....	149	.....	15	11	.....	11

NOTE.—Daily discharge determined by means of a discharge rating curve that is based on three lischarge measurements made during 1911 and the form of the 1910 curve and is poorly defined. Daily lischarge, Mar. 23 to 30, estimated because of ice. Daily discharge, July 1 to Aug. 3, estimated because of rror in reported gage heights. See footnote to table of daily gage height. Daily discharge Sept. 30 interolated.

Monthly discharge of Pembina River at Neche, N. Dak., for 1911.

[Drainage area, 2,940 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
Iarch 23-31	[a] 900	[a] 450	[a] 641	0.218	0.07	11,400	D.
April	420	181	294	.100	.11	17,500	C.
Iay	520	133	231	.079	.09	14,200	B.
une	198	118	154	.052	.06	9,160	B.
uly	[a] 110	[a] 15	[a] 49.2	.017	.02	3,030	D.
August	35	11	24.1	.0082	.009	1,480	C.
September	17	1	5.7	.0019	.002	339	D.
October	35	2	19.6	.0067	.008	1,210	D.
The period	.....	.....	.....	.....	.....	58,300	

[a] Estimated.

NOTE.—See footnotes to tables of daily gage height and daily discharge.

WEST BRANCH OF ROSEAU RIVER NEAR MALUNG, MINN.

Location.—At the highway bridge near the center of sec. 7, T. 161 N., R. 39 W., 6¼ miles south of Roseau, 1 mile west of Malung post office, and half a mile above the mouth of the East Branch.

Records available.—Gage heights and discharge measurements from May 6 to November 15, 1911.

Drainage area.—265 square miles.

Gage.—Vertical staff.

Channel.—Probably fairly permanent, although there is a possibility of temporary backwater from the East Branch.

Discharge measurements.—Made at the bridge except during low stages, when they are made at a wading section. Discharge measurements are also made on the East Branch a short distance above the junction and on Roseau River at Roseau for the purpose of determining the portion of the flow at Roseau that comes from the East Branch, and to estimate the entire flow below that point, as conditions of flow below the junction of the two branches are very unfavorable for the establishment of a regular station.

Winter flow.—From November to April the river is frozen over and observations are discontinued.

Regulation.—Much of the area drained by Roseau River is so swampy that it can not be cultivated without drainage. In connection with this work the river channel has been straightened and widened to 80 feet for a distance of 40 miles; a drainage system benefiting 90,000 acres of land south of the river discharges into the Roseau by 10 ditches 1 mile apart in T. 163, Rs 43 and 44. Another ditch system, draining about 20,000 acres, enters Roseau River in sec. 6, T. 162 N., R. 39 W.

Discharge measurements of West Branch of Roseau River near Malung, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
May 6	E. F. Chandler	2.18	4.9
June 27	do	2.49	9.7
Sept 13[a]	do	1.98	0.44

[a] Float measurement.

Daily gage height, in feet, of West Branch of Roseau River near Malung, Minn., for 1911.

[August Hedin, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.4	2.4	2.15	2.1	2.1	2.1	16	2.45	4.65	2.2	2.25	2.0	2.15	.....
2	.....	2.35	2.4	2.15	2.1	2.1	2.1	17	2.4	4.5	2.2	2.2	2.0	2.1	.....
3	.....	2.55	2.4	2.15	2.05	2.2	2.1	18	2.35	4.1	2.2	2.15	2.0	2.1	.....
4	.....	2.7	2.35	2.15	2.05	2.2	2.1	19	2.3	3.65	2.2	2.1	2.0	2.1	.....
5	.....	3.1	2.3	2.2	2.0	2.2	2.1	20	2.3	3.45	2.2	2.1	2.05	2.1	.....
6	2.2	3.0	2.3	2.25	2.0	2.2	2.1	21	2.3	3.15	2.2	2.2	2.05	2.1	.....
7	2.2	2.8	2.3	2.25	2.0	2.2	2.1	23	2.25	2.95	2.15	2.2	2.1	2.15	.....
8	2.15	3.1	2.45	2.2	2.0	2.2	2.05	23	2.25	2.7	2.15	2.15	2.1	2.15	.....
9	2.15	3.4	2.4	2.15	2.0	2.2	2.05	24	2.2	2.65	2.15	2.1	2.1	2.15	.....
10	2.2	4.6	2.4	2.15	2.0	2.15	2.05	25	2.2	2.5	2.15	2.1	2.1	2.15	.....
11	2.2	6.85	2.35	2.1	2.0	2.15	2.05	26	2.3	2.5	2.15	2.05	2.1	2.1	.....
12	2.3	8.15	2.35	2.05	2.0	2.1	2.2	27	2.3	2.45	2.1	2.1	2.1	2.1	.....
13	2.3	7.9	2.3	2.05	2.0	2.15	2.2	28	2.35	2.45	2.1	2.15	2.1	2.1	.....
14	2.35	6.6	2.3	2.45	2.0	2.2	.....	29	2.3	2.45	2.1	2.1	2.1	2.1	.....
15	2.45	5.3	2.25	2.35	2.0	2.2	.....	30	2.4	2.4	2.1	2.1	2.1	2.1	.....
								31	2.4	.....	2.1	2.1	.....	2.1	.....

Daily discharge, in second-feet, of West Branch of Roseau River near Malung, Minn., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1....	.....	7.6	7.6	3.0	2.2	2.2	2.2	16....	8.7	126	3.8	4.7	.8	3.0	.....
2....	.....	6.6	7.6	3.0	2.2	2.2	2.2	17. ..	7.6	115	3.8	3.8	.8	2.2	.....
3....	.....	11	7.6	3.0	1.5	3.8	2.2	18....	6.6	87	3.8	3.0	.8	2.2	.....
4....	.....	15	6.6	3.0	1.5	3.8	2.2	19....	5.6	58	3.8	2.2	.8	2.2	.....
5....	.....	29	5.6	3.8	.8	3.8	2.2	20....	5.6	46	3.8	2.2	1.5	2.2	.....
6. ..	3.8	25	5.6	4.7	.8	3.8	2.2	21....	5.6	31	3.8	3.8	1.5	2.2	.....
7....	3.8	18	5.6	4.7	.8	3.8	2.2	22....	4.7	23	3.0	3.8	2.2	3.0	.....
8....	3.0	29	8.7	3.8	.8	3.8	1.5	23....	4.7	15	3.0	3.0	2.2	3.0	.....
9....	3.0	43	7.6	3.0	.8	3.8	1.5	24....	3.8	14	3.0	2.2	2.2	3.0	.....
10....	3.8	122	7.6	3.0	.8	3.0	1.5	25....	3.8	9.8	3.0	2.2	2.2	3.0	.....
11....	3.8	342	6.6	2.2	.8	3.0	1.5	26....	5.6	9.8	3.0	1.5	2.2	2.2	.....
12....	5.6	507	6.6	1.5	.8	2.2	3.8	27....	5.6	8.7	2.2	2.2	2.2	2.2	.....
13....	5.6	473	5.6	1.5	.8	3.0	.....	28....	6.6	8.7	2.2	3.0	2.2	2.2	.....
14....	6.6	314	5.6	8.7	.8	3.8	.....	29....	5.6	8.7	2.2	2.2	2.2	2.2	.....
15....	8.7	182	4.7	6.6	.8	3.8	.....	30....	7.6	7.6	2.2	2.2	2.2	2.2	... ..
								31....	7.6	.....	2.2	2.2	.....	2.2	.....

NOTE.—Discharge Nov. 13 to Dec. 31 estimated by E. F. Chandler from climatologic records, discharge of adjacent drainage areas, and the fact that the observer kept watch of the stream in order to report any marked variation in discharge. It should be noted that these estimates are based on less data than estimates at most of the stations in this report and that they simply represent the best values available for publication. Mean discharge Nov. 13 to 30 estimated 2 second-feet. Mean discharge Dec. 1 to 31 estimated 1.5 second-feet.

Monthly discharge of West Branch of Roseau River near Malung, Minn., for 1911.

[Drainage area, 265 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
May 6-31	8.7	3.0	5.50	0.021	0.02	C.
June	507	6.6	89.8	.339	.38	B.
July	8.7	2.2	4.77	.018	.02	C.
August	8.7	1.5	3.22	.012	.01	C.
September	2.2	.8	1.41	.0053	.006	D.
October	3.8	2.2	2.87	.011	.01	D.
November	3.8	.....	2.04	.0077	.009	
December	.....	.....	1.5	.0057	.007	

NOTE.—See footnotes to table of daily discharge.

MOUSE RIVER AT MINOT, N. DAK.

Location.—At the Anne Street footbridge northeast of the Great Northern Railway roundhouse at Minot, N. Dak.

Records available.—May 5, 1903, to December 31, 1911.

Drainage area.—8,400 square miles.

Gage.—Vertical staff attached to pier of the Anne Street Bridge. The original gage, superseded in 1910 by this gage, was at a bridge about 40 rods farther upstream. At low stage, because the water is ponded by a dam below, there is no appreciable slope in the water surface and the gage zeros at the old and present sites have the same elevation; at high stage there is a slight slope in the water surface; hence, at highest stage the present gage would read slightly less than the original gage would have done, but the difference is probably less than 0.1 foot, even at extreme high water. Datum unchanged.

Channel.—Clay and silt; slightly shifting.

Discharge measurements.—Made from the Anne Street Bridge at medium and high stages. At low stage made by wading some rods below the dam at the Minneapolis, St. Paul & Sault Ste. Marie Railway water tank.

Winter flow.—The relation of gage height to discharge is somewhat affected by ice from about the middle of November to the middle of April; if the river is low enough to be controlled at the gage entirely by the weir formula due to the dam, the effect of the ice is not so considerable. In most winters the discharge is very small, as has been found by actual discharge measurement occasionally. Thus, from a few gage readings each winter estimates of flow may be made which are not in error to the amount of a large quantity of water.

Regulation.—A dam 4 feet high at the Minneapolis, St. Paul & Sault Ste. Marie Railway water tank, 1 mile below the gage (along the channel), raises the water at the gage about 3 feet at ordinary low stage. The dam has no sluices, being designed merely to give enough depth of water for the intake-pipe suction; but it is not absolutely tight. When the discharge is less than about 6 second-feet the water level falls below the crest of the dam. The crest of the dam is nearly level and can be considered as a broad-crested weir until (at gage reading about 6.0 feet) corrections for submergence of the weir by the filling of the channel below the weir need be applied. The dam was raised about 0.7 foot in March, 1911; previous to that time ordinary low-water level at the gage was 0.7 foot less than now.

Accuracy.—The percentage errors of the results for the low-water period in 1911 may be largely due to small errors by the gage observer and the undetermined leakage through the dam, although the error is but a few second-feet. At medium stages the results are good.

Discharge measurements of Mouse River at Minot, N. Dak., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Aug. 3	E. F. Chandler	4.49	18.3
17	do	4.54	21.8

NOTE.—Measurements made by wading below the "Soo" Railway's dam.

Daily gage height, in feet, of Mouse River at Minot, N. Dak., for 1911.

[Ephraim Cox, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.40	7.55	5.3	4.8	4.45	4.2	3.7	4.4	.....
2	.....	4.5	7.5	5.4	4.8	4.45	4.15	3.7	4.4	.....
3	.....	4.5	7.45	5.45	4.75	4.5	4.15	3.7	4.45	.....
4	.....	4.55	7.4	5.5	4.75	4.5	4.15	3.75	4.45	.....
5	.....	4.55	7.35	5.45	4.75	4.55	4.2	3.75	4.45	.....
6	.....	4.6	7.3	5.45	4.75	4.55	4.2	3.75	4.45	.....
7	.....	4.6	7.2	5.4	4.7	4.55	4.2	3.75	4.45	.....
8	.....	4.55	7.15	5.4	4.7	4.55	4.25	3.75	4.5	.....
9	.....	4.65	7.1	5.35	4.7	4.55	4.25	3.75	4.5	.....
10	.....	4.8	7.0	5.35	4.65	4.5	4.2	3.85	4.5	.....
11	.....	5.2	6.95	5.3	4.65	4.5	4.2	3.9	.....	.....
12	.....	5.5	6.85	5.3	4.65	4.5	4.15	3.95	.....	.....
13	.....	5.65	6.75	5.25	4.65	4.5	4.15	3.95	.....	.....
14	.....	5.75	6.7	5.25	4.6	4.5	4.0	4.0	.....	.....
15	.....	5.85	6.65	5.2	4.6	4.45	4.0	4.05	.....	4.1

Daily gage height, in feet, of Mouse River at Minot, N. Dak., for 1911—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	.....	5.95	6.55	5.2	4.6	4.45	4.0	4.05	.....	.....
17	.....	6.2	6.45	5.15	4.6	4.45	4.0	4.1	.....	.....
18	.....	6.35	6.3	5.15	4.6	4.45	4.0	4.1	.....	.....
19	4.1	6.5	6.2	5.1	4.6	4.4	3.95	4.1	.....	.....
20	4.1	6.6	6.1	5.1	4.55	4.45	3.95	4.15	.....	.....
21	4.15	6.75	5.95	5.0	4.55	4.45	3.95	4.15	.....	.....
22	4.2	6.85	5.8	5.0	4.55	4.5	3.8	4.15	.....	.....
23	4.2	6.95	5.75	4.9	4.55	4.5	3.8	4.15	.....	.....
24	4.25	7.15	5.6	4.9	4.55	4.5	3.8	4.15	.....	.....
25	4.3	7.3	5.55	4.85	4.55	4.45	3.8	4.2	.....	.....
26	4.35	7.35	5.5	4.85	4.5	4.45	3.75	4.2	.....	.....
27	4.35	7.45	5.45	4.8	4.5	4.4	3.75	4.2	.....	.....
28	4.4	7.55	5.3	4.8	4.5	4.4	3.75	4.3	.....	.....
29	4.4	7.65	5.25	4.8	4.45	4.25	3.7	4.3	.....	.....
30	4.45	7.6	5.25	4.75	4.45	4.25	3.7	4.35	4.2	.....
31	4.45	.....	5.2	.....	4.45	4.2	.....	4.35	.....	4.1

NOTE.—Gage heights July 1 to Nov. 10 above are corrected values, but may be from 0.1 to 0.3 foot in error as result of mistake made by gage observer.

Daily discharge, in second-feet, of Mouse River at Minot, N. Dak., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	14	722	168	64	14	3.6	0.7	10
2	.....	18	712	191	64	14	3.1	.7	10
3	.....	18	702	202	55	18	3.1	.7	14
4	.....	24	691	214	55	18	3.1	.8	14
5	.....	24	680	202	55	24	3.6	.8	14
6	.....	30	670	202	55	24	3.6	.8	14
7	.....	30	648	191	46	24	3.6	.8	14
8	.....	24	636	191	46	24	4.4	.8	18
9	.....	38	625	180	46	24	4.4	.8	18
10	.....	64	601	180	38	18	3.6	1.2	18
11	.....	146	589	168	38	18	3.6	1.4	.....
12	.....	214	564	168	38	18	3.1	1.6	.....
13	.....	250	539	157	38	18	3.1	1.6	.....
14	.....	274	526	157	30	18	1.9	1.9	.....
15	.....	300	512	146	30	14	1.9	2.2	.....
16	.....	325	486	146	30	14	1.9	2.2	.....
17	.....	391	458	135	30	14	1.9	2.6	.....
18	.....	432	418	135	30	14	1.9	2.6	.....
19	2.6	472	391	124	30	10	1.6	2.6	.....
20	2.6	499	364	124	24	14	1.6	3.1	.....
21	3.1	539	325	103	24	14	1.6	3.1	.....
22	3.6	564	287	103	24	18	1	3.1	.....
23	3.6	589	274	83	24	18	1	3.1	.....
24	4.4	636	238	83	24	18	1	3.1	.....
25	5.3	670	226	74	24	14	1	3.6	.....
26	7.6	680	214	74	18	14	.8	3.6	.....
27	7.6	702	202	64	18	10	.8	3.6	.....
28	10	722	168	64	18	10	.8	5.3	.....
29	10	744	157	64	14	4.4	.7	5.3	.....
30	14	733	157	55	14	4.4	.7	7.6	.....
31	14	.....	146	.....	14	3.6	.....	7.6	.....

NOTE.—Daily discharge determined by means of discharge rating curve that was made by considering the Soo Dam as a broad-crested weir, with corrections for velocity of approach, for the slope of the upstream ice, for the submergence or partial submergence of the weir when the reading at the gage is greater than feet, and for the backwater function or slope of the water surface between the weir and the gage, suitable coefficients for use in the computations having been secured by successive approximations until the table fits closely the discharge measurements made during 1911. Discharge Nov. 10 to Dec. 31 estimated, because of ice, from observer's notes, climatologic records, and discharge of adjacent drainage areas. Mean discharge Nov. 10 to 30 estimated 8 second-feet, varying from about 3 to 16 second-feet. Mean discharge Dec. 1 to 31 estimated 2 second-feet.

Monthly discharge of Mouse River at Minot, N. Dak., for 1911.

[Drainage area, 8,400 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
March 19-31	14	2.6	6.80	0.00081	0.0004	175	D.
April	744	14	339	.040	.04	20,200	B.
May	722	146	449	.053	.06	27,600	B.
June	214	55	138	.016	.02	8,210	C.
July	64	14	34.1	.0041	.005	2,100	D.
August	24	3.6	15.6	.0019	.002	959	D.
September	4.4	.7	2.27	.00027	.0003	135	D.
October	7.6	.7	2.55	.00030	.0003	157	D.
November	18	.....	10.1	.0012	.001	601	D.
December	.....	.....	2	.00024	.0003	123	D.
The period	.....	.....	.....	.....	.....	60,300	

NOTE.—See footnotes to tables of daily gage height and daily discharge.

EVAPORATION AT UNIVERSITY, N. DAK.[1]

The evaporation gage at University, N. Dak., was established April 17, 1905. It is located on a pool in a ravine called English Coulee, which runs through the campus of the University of North Dakota, which is immediately west of Grand Forks, N. Dak., and 2 miles west of the Minnesota boundary.

The records at this station were continued in 1911, daily observations being made during the entire open season, except the first two weeks. The gage was protected from disturbance, and the records of observations are reliable.

The coulee drains about 60 square miles of very level prairie. Except for brief freshets the flow in the coulee is small, varying from 1 second-foot or less to 20 second-feet. In very dry weather the water lies in pools with scarcely any perceptible flow.

A heavy galvanized-iron tank, 3 feet square and 18 inches deep, is placed in the center of an anchored raft, so that the water in the tank is at the same level as the water surface outside. The tank is filled nearly to the top, to a height precisely marked by the pointed tip of a vertical rod in the center of the tank. Once each day, after the change produced by evaporation or rainfall, the water level is restored to the original height, the precise amount of water transferred being measured with a cup of such size that one cupful of water is equivalent to 0.01 inch depth in the tank.

A standard rain gage is located on the open prairie about 10 rods distant. On days of rainfall the difference (which is usually small) between the quantity measured by the rain gage and the surplus in the tank is considered the total evaporation for the day.

[1] For complete description of this station and records of evaporation, rainfall, and temperature for 1905, 1908, see Water-Supply Paper U. S. Geol. Survey No. 245, 1910, pp. 64-67.

Observations were made usually about a half hour before sunset. The temperature of the water recorded is the observation of the water in the tank; as the tank is a metal tank, it has been found that at that time of the day there is rarely a perceptible difference in temperature reading between the water within and without the tank. The temperature of the air as recorded is the mean of the readings of the standard self-recording maximum and the self-recording minimum thermometers for the preceding 24 hours.

The following table shows for each 10-day period during 1911 the gross evaporation, the total rainfall, and the mean temperatures for the 10 observations of the water and of the air.

Evaporation, rainfall, and temperature at University, N. Dak., for 1911.

[T. T. Quirke and Thos. G. Johnson, observers.]

Date.	Evaporation.	Rainfall.	Mean temperature.	
			Water.	Air.
	Inches.	*Inches.*	*° F.*	*° F.*
Apr. 22-30	1.80	0.00	51	54
May 1-10	1.60	.64	54	52
May 11-20	.94	1.90	59	61
May 21-31	1.17	.63	62	59
June 1-10	.53	3.83	72	69
June 11-20	1.69	.44	73	67
June 21-30	2.11	.51	73	70
July 1-10	2.01	1.02	76	71
July 11-20	2.05	.26	68	60
July 21-31	2.07	.78	67	64
Aug. 1-10	1.13	1.66	66	65
Aug. 11-20	1.50	.47	72	68
Aug. 21-31	1.36	1.25	60	58
Sept. 1-10	1.03	.56	59	57
Sept. 11-20	.75	.41	56	58
Sept. 21-30	.54	.10	50	48
Oct. 1-10	.46	.83	50	51
Oct. 11-21	.53	.03	53	49
Oct. 21-31	.30	.08	38	28
Total for period	23.57	15.40	.....	.....

RAINY RIVER BASIN.

RAINY RIVER AT INTERNATIONAL FALLS, MINN.

Location.—At the steamboat dock half a mile below the dam at International Falls.

Records available.—March 1, 1907, to December 31, 1911, from Geological Survey records, and August 14 to December 31, 1911, from an independent interpretation of power-house records by the Canadian Department of Public Works.

Drainage area.—14,600 square miles.[1]

Gage.—Vertical staff. Prior to April 20, 1911, the gage heights were furnished through the courtesy of the Minnesota & Ontario Power Co. They were referred to a gage located just below the dam, first on the American side but later on the Canadian side. On April 20, 1911, a gage was installed by the United States Geological Survey at the American steamboat dock below the falls. The zero of the latter gage is 460.99 feet above that of the power company's gage, when the slope[2] of the river between the two points is considered. The gage heights given herein are referred to the Geological Survey gage.

[1] Revised since previous report.

[2] Slope determined at gage height 2.65 feet.

Channel.—Practically permanent.

Discharge measurements.—Discharge measurements for the purpose of rating the section have been made by the Geological Survey since 1909, by means of a boat and cable at a section several hundred yards below the gage, where an island divides the river into two channels. Additional measurements referred to the same gage have been made by Canadian Government engineers and furnished through their courtesy.

Winter flow.—Although the dam prevents ice forming at the power company's gage, which is used during the winter months, ice forms on the rapids several miles below, causing serious backwater at the gage. Since 1909 and 1910 the monthly estimates during the frozen period have been based indirectly on records of flow through the turbines, as kept by the power company, and upon a few discharge measurements. Previous to 1910 the winter estimates can be considered only very approximate.

Regulation.—The low-water flow at the station is controlled by the operation of the power plants at the dam, as shown by the drop in gage heights on Sundays during portions of 1910 and 1911. The flow during the summer and fall months of 1911 does not represent the natural run-off from the drainage basin, as during that period the water level above the dam rose 5 feet. As the dam backs up the water in Rainy Lake, this rise represents a large increase in storage.

Accuracy.—Although the channel is practically permanent, the conditions for measuring the flow are not of the best, and therefore the results of the measurements are somewhat erratic. See "Winter flow."

Discharge measurements of Rainy River at International Falls, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 20	Canadian Government engineers	1.93	5,880
June 7	R. Follansbee and S. B. Soulé	2.68	6,720
July 13	S. B. Soulé	.53	[a] 4,750
14	do	.70	4,010
Aug. 12	Canadian Government engineers	2.73	6,510
Sept. 19	do	2.02	5,910
Dec. 5	do	[b] 3.14	5,890

[a] Rejected; affected by motion of boat due to waves. [b] Backwater from ice.

Daily gage height, in feet, of Rainy River at International Falls, Minn., for 1911.

[George St. Lawrence, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	([a])	1.27	1.17		−0.31	2.30	0.64	2.55	2.71	1.6	1.58	3.30
2	0.47	1.27	1.22		.55	2.24	[a] −.50	2.54	2.70	.95	1.60	3.25
3	1.57	1.47	1.37		.68	2.24	[a] −1.00	2.70	2.70	1.70	1.50	2.80
4	1.87	1.57	1.87		.62	[a] .85	[a] −1.00	2.65	2.36	1.85	1.25	2.66
5	1.77	([a])	([a])		.64	.85	.35	2.45	2.46	1.85	0.68	3.14
6	1.77	.47	1.07		.64	2.60	.78	1.35	2.64	1.9	1.00	3.08
7	2.57	1.47			[a] −.01	2.68	.70	2.35	2.54	1.75	1.35	2.94
8	([a])	1.67			[a] −.13	2.66	.75	2.60	2.60	1.32	1.32	2.96
9	.67	1.67			.72	2.62	[a] .55	2.64	2.50	1.08	1.40	3.09
10	1.87	1.67			.94	3.20	.60	2.74	2.36	1.38	1.68	2.45
11	2.07	1.57			1.66	[a] 1.20	.90	2.85	2.40	1.84	1.25	2.12
12	2.37	([a])			1.60	2.65	.65	2.84	2.40	1.89	2.16	2.60
13		.47			.95	3.90	.70	[a] .62	2.36	1.88	2.69	2.65
14	2.17				[a] −.27	4.04	.74	2.55	2.36	1.69	3.01	2.65
15	([a])				.76	4.12	.90	2.85	2.40	.95	3.20	2.58

[a] Power plant closed.

Daily gage height, in feet, of Rainy River at International Falls, Minn., for 1911—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	.85	.....	.....	.....	1.22	3.98	[a].30	2.74	2.09	1.00	3.18	2.48
17	1.37	.....	.....	.....	2.11	3.15	.61	2.74	[a] 1.35	1.58	3.22	1.98
18	1.87	.....	.....	1.26	1.51	[a] 1.00	.64	2.94	[a] 1.21	1.78	3.25	1.52
19	1.37	.....	.....	1.01	1.98	1.24	.53	2.80	2.00	1.89	1.60	2.42
20	1.27	.....	.....	1.08	1.92	2.66	− .04	[a] 1.95	2.15	2.04	2.31	2.56
21	1.27	.....	.....	.95	[a]−.25	2.90	− .08	2.40	2.00	1.75	3.25	2.50
22	([a])	.....	.....	.94	1.06	2.84	− .08	2.74	1.72	1.19	3.35	2.48
23	.47	.....	.....	.30	2.06	2.38	([a])	2.74	2.01	1.00	3.35	2.41
24	1.07	.....	.....	.52	2.16	1.80	([a])	2.92	[a] 1.25	1.05	3.50	.95
25	.87	1.17	.....	.58	2.17	[a] 1.80	.72	2.72	[a].61	1.75	3.68	.10
26	.97	([a])	.....	.40	1.85	1.61	2.11	2.88	1.70	1.84	3.08	1.85
27	1.07	.37	.....	.30	2.13	1.70	2.31	[a] 1.92	1.70	1.92	2.10	3.38
28	1.37	1.07	.....	.16	[a]−.01	1.65	2.52	2.40	1.82	1.84	3.08	3.65
29	([a])	.....	.....	.04	.78	1.49	2.68	2.55	1.90	1.48	3.22	3.70
30	.37	.....	.....	− .29	2.10	.75	[a].31	2.71	1.92	.90	3.28	3.48
31	1.17	.....	.....	.....	2.26	.....	1.41	2.70	.....	1.40	.....	2.55

[a] Power plant closed.

NOTE.—There was backwater from ice gorging in rapids below the station Mar. 1 to 31 and Dec. 1 to 31, 1907; Jan. 1 to Feb. 28, and Dec. 1 to 31, 1908; Jan. 1 to Mar. 31, and Nov. 27 to Dec. 31, 1909; Jan. 1 to Apr. 10, and Dec. 1 to 31, 1910; Jan. 1 to Mar. 31, and Nov. 13 to Dec. 31, 1911.

Daily discharge, in second-feet, of Rainy River at International Falls, Minn., for 1907–1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1907.								
1	5,840	6,270	10,500	11,700	13,200	17,200	17,800	16,400
2	5,270	6,490	10,300	11,900	13,200	17,200	17,800	16,400
3	5,270	6,720	10,100	12,200	13,200	17,200	17,800	16,300
4	5,130	7,020	9,820	12,300	13,200	17,200	17,700	16,200
5	4,990	7,170	9,660	12,400	13,300	17,200	17,700	16,200
6	4,990	7,320	9,500	12,500	13,300	17,200	17,800	16,200
7	5,130	7,240	9,580	12,600	13,300	17,200	17,800	16,100
8	5,270	7,160	9,660	12,700	13,500	17,200	17,800	16,100
9	5,130	7,320	9,580	12,700	13,500	17,300	17,700	16,100
10	5,130	7,160	9,500	12,800	13,500	17,300	17,800	16,000
11	5,270	7,320	9,500	12,800	14,700	17,300	17,700	15,900
12	5,130	7,320	9,660	12,900	15,900	17,200	17,700	15,700
13	5,130	7,320	9,740	12,900	16,100	17,300	17,700	15,600
14	5,130	7,160	9,820	13,000	16,100	17,300	17,700	15,400
15	4,990	7,550	9,870	13,000	16,100	17,300	17,500	15,400
16	4,860	7,940	9,820	13,000	15,900	17,300	17,300	15,400
17	4,860	8,710	9,980	13,100	15,600	17,300	17,300	15,300
18	5,130	9,180	9,980	13,200	15,600	17,300	17,300	15,200
19	5,270	9,660	10,100	13,300	16,100	17,300	17,300	15,100
20	5,270	9,820	10,100	13,400	16,100	17,700	17,200	15,100
21	5,340	9,820	10,200	13,500	16,200	17,700	17,000	14,900
22	5,410	9,660	10,400	13,600	16,200	17,900	16,800	14,800
23	5,900	9,660	10,600	13,700	16,200	18,100	16,700	14,600
24	6,400	9,820	10,800	13,700	16,200	18,100	16,500	14,600
25	6,860	9,820	10,900	13,600	16,300	18,100	16,500	14,600
26	6,860	9,980	11,000	13,600	16,400	18,100	16,500	14,500
27	7,020	10,100	11,100	13,500	16,500	18,100	16,400	14,500
28	6,560	10,800	11,200	13,500	16,500	18,100	16,400	14,400
29	6,560	10,800	11,300	13,400	16,600	18,000	16,500	14,400
30	6,420	10,600	11,500	13,300	16,700	18,000	16,500	14,400
31	.....	10,600	.....	13,300	17,200	.....	16,500	.....
1908.								
1	.....	.....	.....	13,200	14,500	12,800	10,900	8,630
2	.....	.....	.....	13,200	14,500	12,600	10,800	8,560
3	.....	.....	12,400	13,200	14,400	12,500	10,800	8,400
4	.....	.....	.....	13,200	14,300	12,400	10,700	8,240
5	.....	.....	.....	13,200	14,200	12,300	10,600	8,240
6	.....	.....	.....	13,200	14,100	12,200	10,500	8,090
7	4,580	.....	.....	13,400	14,100	12,100	10,400	7,940
8	.....	.....	.....	13,500	14,000	12,100	10,300	7,860
9	.....	.....	14,600	13,400	14,000	12,000	10,200	7,780
10	.....	.....	.....	13,400	14,000	12,000	10,100	7,780

Daily discharge, in second-feet, of Rainy River at International Falls, Minn., for 1907–1911—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1908.								
11	.....	.....	.....	13,300	14,000	11,900	10,000	7,620
12	.....	.....	.....	13,400	14,000	11,800	9,930	7,620
13	.....	.....	15,300	13,500	14,000	11,700	9,840	7,620
14	.....	.....	.....	13,500	14,000	11,600	9,750	7,620
15	.....	11,400	.....	13,600	14,000	11,500	9,660	7,470
16	.....	.....	.....	13,700	14,000	11,400	9,660	7,320
17	.....	.....	.....	14,200	14,000	11,400	9,500	7,320
18	7,470	.....	12,500	14,700	14,000	11,400	9,420	7,320
19	.....	.....	.....	15,100	13,900	11,400	9,340	7,320
20	.....	.....	.....	15,400	13,800	11,200	9,260	7,320
21	.....	.....	.....	15,300	13,700	11,100	9,180	7,160
22	.....	.....	.....	15,200	13,500	11,100	9,120	7,090
23	.....	.....	.....	15,100	13,200	11,000	9,070	7,020
24	.....	.....	.....	15,000	12,900	11,000	9,020	7,020
25	.....	.....	.....	14,900	12,700	11,000	9,020	6,860
26	.....	.....	13,000	14,800	12,500	10,900	9,020	6,860
27	.....	14,000	.....	14,700	12,500	10,900	8,940	6,860
28	.....	.....	.....	14,600	12,600	10,900	8,860	6,860
29	.....	.....	.....	14,600	12,700	10,900	8,860	6,790
30	12,900	.....	.....	14,600	12,800	10,900	8,710	6,720
31	.....	.....	.....	14,500	12,900	.....	8,710	.....
1909.								
1	5,550	2,380	976	10,900	9,340	8,710	8,710	8,860
2	5,270	2,500	1,900	10,900	9,340	8,240	8,560	8,510
3	5,130	2,530	3,140	11,100	9,500	8,710	8,560	8,130
4	5,060	2,560	4,720	11,000	10,100	9,340	8,560	7,750
5	4,990	2,590	5,270	10,900	9,820	9,420	8,560	7,370
6	4,450	2,630	5,690	11,100	9,980	9,500	9,820	6,990
7	4,380	3,010	4,580	10,900	10,100	8,400	9,820	6,610
8	4,320	3,390	4,860	11,100	10,200	7,940	9,820	6,230
9	4,180	3,780	5,980	11,100	10,300	9,020	9,820	5,750
10	4,050	3,920	6,120	11,000	10,800	9,500	9,900	5,480
11	3,920	3,920	6,420	10,800	11,100	10,100	9,980	5,100
12	3,780	3,920	6,120	10,800	11,100	10,200	10,100	4,720
13	2,380	4,860	6,490	9,820	12,900	10,300	10,300	3,920
14	2,260	7,160	6,860	9,980	13,700	10,100	10,100	3,990
15	2,260	7,500	7,020	9,820	13,600	10,100	9,050	4,050
16	2,260	7,500	7,160	10,300	13,500	10,100	8,530	4,140
17	2,140	7,300	7,020	10,300	13,000	10,100	8,020	4,230
18	1,780	7,000	7,160	10,800	12,400	10,100	7,520	4,320
19	1,430	6,860	7,160	11,300	12,100	9,330	7,020	4,320
20	1,430	5,980	7,160	11,300	11,900	8,560	7,160	4,450
21	431	4,990	7,160	11,300	12,400	8,560	7,620	4,600
22	1,200	4,180	8,400	11,300	12,000	8,710	8,240	4,720
23	1,320	3,520	8,560	10,900	11,700	8,710	8,560	5,130
24	1,550	3,010	9,020	10,500	10,800	8,860	9,180	4,320
25	1,660	2,500	9,340	10,300	10,000	8,860	9,340	3,520
26	1,780	1,900	9,500	10,100	7,320	8,860	9,820	3,920
27	1,900	1,550	9,980	9,020	7,470	8,860	9,980	5,190
28	1,780	1,200	10,300	9,660	7,680	8,860	9,660	5,190
29	1,900	865	10,600	9,820	7,880	8,860	9,660	5,190
30	2,140	646	10,900	9,500	8,090	8,710	9,340	5,190
31	.....	755	.....	9,500	7,940	.....	9,180	.....
1910.								
1	6,000	11,700	8,660	9,620	4,010	5,370	4,950	6,660
2	6,500	11,900	10,300	9,780	6,080	5,090	2,500	3,460
3	7,000	11,900	8,660	9,780	6,080	5,090	4,810	6,520
4	7,500	11,700	8,660	9,680	6,370	5,090	4,810	6,820
5	8,000	11,700	8,660	8,040	6,150	5,090	4,810	6,820
6	8,500	11,700	9,140	8,980	6,150	5,090	4,810	2,500
7	9,000	11,700	10,900	8,660	4,140	5,090	5,910	3,420
8	9,500	11,700	10,300	7,270	5,370	5,090	5,510	6,600
9	10,000	11,700	11,900	7,040	6,230	5,090	5,510	6,600
10	10,500	12,000	11,500	6,370	5,510	5,090	2,420	6,620
11	10,600	12,200	11,900	7,120	4,810	5,090	5,790	6,600
12	10,600	12,500	11,900	6,670	5,230	5,090	5,790	6,740
13	10,400	12,500	11,100	6,970	5,370	5,230	6,010	2,000
14	10,400	9,620	11,900	6,820	4,410	4,950	6,230	5,510
15	10,600	9,620	11,400	6,670	4,410	4,950	6,370	6,600

Daily discharge, in second-feet, of Rainy River at International Falls, Minn., for 1907–1911—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1910.								
16	10,600	9,780	11,500	6,370	4,410	4,950	2,340	6,740
17	10,700	9,780	11,400	6,370	5,090	4,950	3,480	6,970
18	11,700	10,400	8,590	3,610	5,090	5,090	5,300	7,120
19	13,000	10,900	8,590	6,150	5,230	5,090	6,010	7,660
20	13,600	7,970	8,660	6,080	5,230	5,090	6,080	2,500
21	13,600	8,900	8,660	5,940	5,230	5,090	6,010	6,970
22	13,600	8,040	9,460	5,510	5,230	5,090	6,150	8,660
23	13,600	11,100	9,300	4,950	3,740	5,090	2,500	8,040
24	12,900	11,100	10,400	4,950	5,230	5,090	3,600	7,580
25	12,300	10,300	10,300	4,870	5,370	5,090	6,640	7,730
26	12,300	8,660	10,300	4,680	5,370	5,230	6,640	7,420
27	11,700	9,780	9,460	4,460	5,490	4,950	6,600	2,000
28	11,700	9,780	9,460	4,460	6,820	5,090	6,500	4,140
29	11,700	9,680	9,460	5,650	3,740	5,090	6,520	6,370
30	11,400	9,280	8,980	5,940	5,650	4,950	2,500	7,120
31	.....	9,280	.....	6,080	5,510	.....	5,480	.....
1911.								
1	2,600	2,740	6,270	3,970	6,640	6,880	5,270	5,240
2	2,600	3,850	6,180	2,500	6,620	6,860	4,380	5,270
3	2,800	4,020	6,180	1,900	6,860	6,860	5,410	5,130
4	2,800	3,940	4,250	1,900	6,790	6,360	5,620	4,790
5	3,000	3,970	4,250	3,590	6,490	6,500	5,620	4,020
6	3,000	3,840	6,720	4,150	3,570	6,780	5,690	4,450
7	3,200	3,120	6,840	4,050	6,340	6,620	5,480	4,920
8	3,200	2,970	6,800	4,110	6,720	6,720	4,880	4,880
9	3,400	4,070	6,740	3,850	6,780	6,560	4,560	4,990
10	3,400	4,370	7,620	3,920	6,920	6,360	4,960	5,380
11	3,600	5,350	4,720	4,320	7,090	6,420	5,610	4,790
12	3,600	5,270	6,790	3,980	7,080	6,420	5,680	6,070
13	3,800	4,380	8,710	4,050	3,940	6,360	5,660	5,900
14	4,000	2,790	8,930	4,100	6,640	6,360	5,400	5,800
15	4,200	4,130	9,060	4,320	7,090	6,420	4,380	5,750
16	4,400	4,750	8,830	3,520	6,920	5,970	4,450	5,700
17	4,600	5,990	7,550	3,930	6,920	4,920	5,240	5,550
18	4,800	5,140	4,450	3,970	7,220	4,730	5,520	5,400
19	4,460	5,810	4,770	3,820	7,020	5,840	5,680	5,270
20	4,560	5,720	6,800	3,080	5,760	6,050	5,890	5,300
21	4,380	2,820	7,160	3,030	6,420	5,840	5,480	5,400
22	4,370	4,530	7,080	3,030	6,920	5,440	4,710	5,500
23	3,520	5,920	6,390	2,200	6,920	5,850	4,450	5,600
24	3,810	6,070	5,550	2,200	7,200	4,790	4,520	5,700
25	3,890	6,080	5,550	4,070	6,900	3,930	5,480	5,800
26	3,650	5,620	5,280	5,990	7,140	5,410	5,610	5,900
27	3,520	6,020	5,410	6,280	5,720	5,410	5,720	5,980
28	3,340	3,120	5,340	6,600	6,420	5,580	5,610	5,970
29	3,190	4,150	5,120	6,840	6,640	5,690	5,100	5,950
30	2,770	5,980	4,110	4,870	6,880	5,720	4,320	5,900
31	.....	6,210	.....	5,000	6,860	.....	4,990	.....

NOTE.—Daily discharge computed from a rating curve fairly well defined below 12,000 second-feet. Discharge estimated for days of missing gage heights, except from April 1 to June 30, 1908. Discharge estimated May 15 to 18, 1909, on account of possible backwater from Little Fork River. Daily discharge estimated Aug. 25, Nov. 27 to 30, 1909; Apr. 1 to 10, 1910; Apr. 1 to 17, Nov. 13 to 18, 20 to 26, and 28 to 30, 1911. No daily discharge estimate during greater part of winter period.

Daily discharge, in second-feet, of Rainy River at International Falls, Minn., for 1911.[a]

[Drainage area, 14,600 square miles.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	6,480	5,180	4,970	5,630
2	.....	6,515	4,110	4,850	5,615
3	.....	6,586	5,250	4,890	4,815
4	.....	5,835	5,505	4,400	4,605
5	.....	6,056	5,500	4,220	5,570
6	.....	6,415	5,560	4,260	5,575
7	.....	6,180	5,220	4,770	5,605
8	.....	6,300	4,475	4,785	5,690
9	.....	6,120	4,160	5,012	6,095
10	.....	5,700	4,680	4,987	5,090

[a] From interpretation of power-house records by Canadian Department of Public Works.

Daily discharge, in second-feet, of Rainy River at International Falls, Minn., for 1911—Continued.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.
11	.....	5,690	5,470	4,760	4,635
12	.....	5,980	5,480	4,315	5,645
13	.....	5,990	5,490	4,250	5,670
14	4,820	5,950	5,050	5,060	5,660
15	6,750	5,930	4,180	5,350	5,650
16	6,730	5,990	4,100	5,420	5,705
17	6,470	4,948	4,675	5,445	4,940
18	6,385	4,445	5,300	5,555	4,370
19	6,650	6,055	5,490	3,070	5,670
20	5,134	5,838	5,470	3,895	5,700
21	4,847	5,660	4,880	5,630	5,670
22	6,540	5,660	4,500	5,620	5,700
23	6,585	5,570	4,480	5,595	5,640
24	6,711	4,595	5,015	5,915	1,080
25	6,510	4,225	5,435	6,190	2,000
26	6,740	5,150	5,445	5,110	5,355
27	5,294	5,270	5,475	4,090	5,990
28	4,968	5,550	5,260	5,620	6,100
29	6,500	5,520	4,410	5,650	6,085
30	6,510	5,560	3,960	5,625	5,705
31	6,500	.....	4,840	.....	3,330

Monthly discharge of Rainy River at International Falls, Minn., for 1907–1911.[a]

[Drainage area, 14,600 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1907.						
March	.....	.....	[b] 5,500	0.377	0.43	C.
April	7,020	4,860	5,550	.380	.42	B.
May	10,800	6,270	8,500	.582	.67	A.
June	11,500	9,500	10,200	.699	.78	A.
July	13,700	11,700	13,000	.890	1.03	B.
August	17,200	13,200	15,200	1.04	1.20	A.
September	18,100	17,200	17,500	1.20	1.34	A.
October	17,800	16,400	17,200	1.18	1.36	A.
November	16,400	14,400	15,400	1.05	1.17	A.
December	.....	.....	[b] 13,000	.890	1.03	B.
1908.						
January	.....	.....	[b] 12,000	.822	.95	C.
February	.....	.....	[b] 11,100	.753	.78	C.
March	.....	.....	[b] 9,280	.636	.73	B.
April	.....	.....	[b] 7,940	.544	.61	B.
May	.....	.....	[b] 12,700	.870	1.00	B.
June	.....	.....	[b] 13,600	.932	1.04	B.
July	15,400	13,200	14,100	.966	1.11	A.
August	14,500	12,500	13,700	.938	1.08	A.
September	12,800	10,900	11,600	.795	.89	A.
October	10,900	8,710	9,680	.663	.76	A.
November	8,630	6,720	7,510	.514	.57	A.
December	.....	.....	[b] 6,500	.445	.51	B.
The year	.....	.....	10,800	.740	10.03	
1909.						
January	.....	.....	[b] 6,000	.411	.47	C.
February	.....	.....	[b] 5,500	.377	.39	C.
March	.....	.....	[b] 5,500	.377	.43	C.
April	5,550	431	2,890	.198	.22	A.
May	7,500	646	3,760	.258	.30	A.
June	10,900	976	6,850	.469	.52	A.
July	11,300	9,020	10,600	.726	.84	A.

[a] Revised since publication of "Report on water resources investigation of Minnesota during 1909–1910."
[b] Estimated.

Monthly discharge of Rainy River at International Falls, Minn., for 1907–1911—Contd.

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1909.						
August	13,700	7,320	10,600	0.726	0.84	A.
September	10,300	7,940	9,250	.634	.71	A.
October	10,300	7,020	9,050	.620	.71	A.
November	8,860	3,520	5,400	.370	.41	A.
December	.....	.....	[a] 5,000	.342	.39	B.
The year	13,700	431	6,700	.459	6.23	
1910.						
January	.....	.....	[a] 4,500	.308	.36	C.
February	.....	.....	[a] 4,500	.308	.32	C.
March	.....	.....	[a] 5,000	.342	.39	C.
April	13,600	6,000	10,600	.726	.81	B.
May	12,500	7,970	10,600	.726	.84	B.
June	11,900	8,590	10,000	.685	.76	B.
July	9,780	3,610	6,630	.454	.52	B.
August	6,820	3,740	5,280	.361	.42	B.
September	5,370	4,950	5,080	.348	.39	B.
October	6,640	2,340	5,120	.351	.40	B.
November	8,660	2,000	6,020	.412	.46	B.
December	.....	.....	[b] 4,300	.295	.34	B.
The year	13,600	.....	6,470	.443	6.01	
1911.						
January	.....	.....	[b] 2,860	.196	.23	C.
February	.....	.....	[b] 2,380	.163	.17	C.
March	.....	.....	[b] 2,530	.173	.20	C.
April	4,800	[a] 2,600	3,620	.248	.28	B.
May	6,210	2,740	4,600	.315	.36	A.
June	9,060	4,110	6,320	.433	.48	A.
July	6,840	1,900	3,970	.272	.31	A.
August	7,220	3,570	6,560	.449	.52	A.
September	6,880	4,730	5,990	.410	.46	A.
October	5,890	4,320	5,210	.357	.41	A.
November	6,070	4,020	5,410	.371	.41	A.
December	.....	.....	[b] 5,900	.404	.47	B.
The year	9,060	.....	4,610	.316	4.30	

[a] Estimated. [b] Estimate based on record of Minnesota & Ontario Power Co.

Monthly discharge of Rainy River at International Falls, Minn., for 1911.

[Drainage area, 14,600 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
August 14–31	6,750	4,820	6,100	0.418	0.28
September	6,590	4,220	5,730	.392	.44
October	5,560	3,960	4,970	.340	.39
November	6,190	3,070	4,980	.341	.38
December	6,100	1,080	5,180	.355	.41

NOTE.—Computed by engineers of the United States Geological Survey from the daily discharge values determined from power-house records and furnished by S. B. Johnson, hydraulic engineer, department of public works, Canada. See also table computed from data obtained at the United States Geological Survey gaging station for the same period.

RAINY LAKE AT RANIER, MINN.

Location.—At the foot of Rainy Lake at the foot of the Ranier wharf.

Records available.—January 1, 1910, to December 31, 1911.

Gage.—Vertical staff. Prior to August 19, 1911, the gage heights were taken at the upper gage of the Minnesota & Ontario Power Co., just above the dam at International Falls, 2 miles below Ranier. This dam controls the level of Rainy Lake, which has an area of approximately 344 square miles. Owing to the great number of small islands in the lake its effective capacity is somewhat uncertain, as the existing maps are too small to show this accurately. Beginning August 19, 1911, the gage heights refer to the gage established by the Canadian Department of Public Works. The datum of this gage is 489 feet above that of the Minnesota & Ontario Power Co.'s gage. Readings of the two gages indicate a slope of 0.50 feet between the two points. Thus to make the records at the two points comparable the readings on the Minnesota & Ontario gage have been reduced by 488.50 feet.

The records at this station, by indicating the change of water level, show the gain or loss in storage due to the control of the flow at the International Falls dam, and when used in connection with the records of flow of Rainy River at International Falls are of value in determining the natural run-off.

Daily gage height, in feet, of Rainy Lake at Ranier, Minn., for 1911.

[George Schiller, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	+0.15	−0.15	−0.35	−0.90	0.55	1.35	.....	4.53	4.56	4.20	3.92	3.58
2	− .05	− .20	− .45	− .68	.55	1.43	3.75	4.58	4.55	4.20	3.82	3.56
3	− .10	− .20	− .55	− .65	.65	.....	.....	4.58	4.53	4.20	3.82	3.54
4	− .10	.....	.....	− .65	.70	1.75	3.80	4.50	4.53	4.20	3.85	3.52
5	− .15	− .05	− .45	− .67	.70	1.50	3.75	.....	4.53	4.20	3.86	3.50
6	− .45	− .15	− .60	− .65	.....	1.65	3.75	4.72	4.52	4.20	3.86	3.50
7	.....	− .20	.....	.....	.80	1.85	4.00	4.70	4.50	4.20	3.82	3.50
8	− .10	− .30	.....	− .70	.75	1.86	.....	4.68	4.48	4.20	3.83	3.50
9	− .25	− .25	.....	− .65	.67	2.00	3.90	4.61	4.46	4.20	3.79	3.50
10	− .25	− .30	− .75	− .60	.29	.....	3.80	4.63	4.44	4.20	3.70	3.48
11	− .45	.....	.....	− .37	.35	2.65	.....	4.60	4.40	4.20	.....	3.46
12	− .35	− .15	− .75	− .45	.76	2.35	4.05	4.80	4.40	4.20	3.64	3.44
13	− .40	.....	.....	− .35	.....	2.40	4.07	4.60	4.40	4.20	3.71	3.42
14	.....	.....	− .85	.....	1.23	2.50	4.10	4.65	4.38	4.20	3.76	3.40
15	− .02	.....	.....	− .10	.81	2.45	.....	4.65	4.35	4.18	3.80	3.38
16	− .15	.....	− .55	− .10	.60	2.53	4.20	4.65	4.35	4.18	3.80	3.36
17	− .35	.....	− .65	− .10	1.05	.....	4.25	4.54	4.34	4.18	3.80	3.35
18	− .20	.....	.....	.00	.73	2.75	4.30	4.55	4.26	4.16	3.80	3.35
19	− .05	.....	− .65	+ .05	.63	2.79	4.35	4.62	4.28	4.13	3.80	3.33
20	− .22	.....	− .65	+ .17	.....	2.84	4.35	4.60	4.29	4.08	3.76	3.31
21	.....	.....	− .75	+ .30	.97	2.90	4.35	4.60	4.28	4.12	3.74	3.29
22	− .15	.....	− .65	+ .33	.80	3.00	.....	4.59	4.29	4.12	3.73	3.27
23	− .10	.....	− .65	+ .37	.72	.....	4.45	4.58	4.29	4.09	3.72	3.25
24	− .05	− .25	− .65	+ .40	.85	.....	4.47	4.52	4.26	4.08	3.71	3.23
25	− .10	.....	− .65	+ .55	1.00	3.24	4.28	4.52	4.25	4.03	3.70	3.22
26	− .15	− .25	− .65	+ .60	1.00	3.25	4.25	4.54	4.20	4.03	3.68	3.20
27	− .20	− .40	− .65	.....	.....	3.34	4.32	4.60	4.20	4.00	3.66	3.18
28	.....	− .35	− .55	.....	1.20	3.55	4.28	4.61	4.20	3.89	3.64	3.17
29	− .05	.....	− .60	+ .65	1.14	3.57	.....	4.60	4.21	3.92	3.62	3.16
30	− .20	.....	− .65	.....	1.20	3.60	4.43	4.61	4.20	3.92	3.60	3.15
31	− .20	.....	.....	.....	1.25	.....	.....	4.60	.....	.....	.....	.....

LITTLE FORK RIVER AT LITTLE FORK, MINN.

Location.—At the lower of the two highway bridges in Little Fork in sec. 9, T. 68 N., R. 25 W., 1½ miles above the mouth of Beaver Brook.

Records available.—June 23, 1909, to December 31, 1911.

Drainage area.—1,720 square miles.

Gage.—Vertical staff; datum unchanged since establishment.

Channel.—Practically permanent, except for temporary backwater from log jams at the railroad bridge below the station.

Discharge measurements.—Made from the bridge.

Winter flow.—The river is completely frozen over at the station from November to April.

Utilization.—Log driving, although there are no logging dams on the river for the purpose of controlling the natural flow.

Discharge measurements of Little Fork River at Little Fork, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Apr. 4[a]	C. R. Adams	10.80	1,400
18[b]	Robert Follansbee	15.46	3,730
19[b]	do	15.00	3,580
June 9	S. B. Soulé	11.06	2,390
July 15	do	5.20	144
Dec. 12[c]	do	6.00	156

[a] Measurement under ice cover.
[b] Backwater from log jam.
[c] Under complete ice cover about 300 feet above gage; average thickness of ice 0.71 foot; 9 inches snow on ice; water about 0.15 foot over ice.

Daily gage height, in feet, of Little Fork River at Little Fork, Minn., for 1911.

[Herman Muus, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	12.50	9.18	8.41	6.08	7.05	6.42	6.20	5.80	.....
2	.....	11.80	9.05	9.20	6.00	7.40	6.32	6.21	5.80	.....
3	.....	11.45	8.90	9.70	5.80	7.25	6.05	6.26	5.80	.....
4	.....	10.80	8.65	10.10	5.72	7.16	5.94	6.35	5.80	5.9
5	.....	10.20	8.30	10.00	5.65	7.12	6.10	6.50	5.80	.....
6	.....	9.95	7.90	10.92	5.62	6.95	6.35	6.49	5.80	.....
7	.....	9.75	7.65	11.50	5.58	6.95	6.65	6.40	5.80	5.9
8	.....	9.25	7.40	10.80	5.50	7.15	7.30	6.35	5.80	.....
9	.....	8.88	7.35	11.20	5.42	7.05	7.45	6.25	5.80	.....
10	.....	8.70	7.20	11.35	5.37	6.88	7.70	6.18	5.88	.....
11	.....	8.68	7.40	13.90	5.35	6.75	7.72	6.05	5.90	5.9
12	.....	9.75	7.55	14.80	5.31	6.35	7.70	5.95	5.90	6.0
13	.....	13.25	7.58	16.77	5.26	6.51	7.60	5.95	6.0	.....
14	.....	15.95	7.65	17.20	5.22	6.59	7.50	5.92	.....	6.05
15	.....	17.70	7.68	16.00	5.20	6.60	7.30	5.90	.....	.....
16	.....	18.30	7.69	14.72	5.20	6.42	7.15	5.92	6.35	.....
17	.....	16.45	7.58	12.74	5.20	6.32	6.80	6.00	.....	.....
18	.....	15.39	7.95	10.04	5.20	6.30	6.50	6.00	.....	6.10
19	.....	15.05	8.50	9.72	5.19	6.12	6.50	6.10	.....	.....
20	.....	14.30	8.35	9.05	5.19	5.96	6.40	6.10	5.7	.....
21	.....	12.60	8.20	8.40	5.20	5.80	6.32	6.10	.....	6.15
22	.....	12.60	8.50	7.91	5.20	5.95	6.10	6.05	.....	.....
23	.....	12.25	8.70	7.45	5.16	5.80	5.95	6.00	5.9	.....
24	.....	11.80	8.55	7.00	5.20	5.75	5.90	5.95	.....	.....
25	.....	11.34	7.70	7.00	5.24	5.74	5.95	5.80	.....	6.10
26	.....	10.75	7.70	6.81	5.25	5.96	5.85	5.80	.....	.....
27	.....	10.32	7.95	6.48	5.39	6.15	5.80	5.78	5.9	.....
28	11.30	10.00	9.31	6.37	5.64	6.42	5.90	5.72	.....	6.10
29	12.15	9.59	9.20	6.24	5.68	6.31	6.35	5.70	6.0	.....
30	12.50	9.38	8.40	6.18	5.60	6.30	6.25	5.76	.....	.....
31	12.50	.....	8.00	.....	6.60	6.30	.....	5.80	.....	.....

NOTE.—Ice present Jan. 1 to Apr. 7 and Nov. 10 to Dec. 31. Ice at gage about 8 to 16 inches thick during November and about 18 inches thick during December. Backwater from log jams Apr. 12 to 20 and June 10 to 17.

Daily discharge, in second-feet, of Little Fork River at Little Fork, Minn., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	900	1,540	1,190	363	665	458	395	289
2	1,000	1,480	1,540	365	793	429	398	289
3	1,150	1,410	1,770	312	738	354	412	289
4	1,400	1,300	1,950	269	705	325	438	289
5	1,400	1,150	2,260	252	690	368	482	289
6	1,450	989	2,320	245	630	438	479	289
7	1,500	890	2,610	235	630	529	452	289
8	1,570	793	2,260	216	701	756	438	289
9	1,400	774	2,460	198	665	811	409	289
10	1,320	719	2,540	186	605	909	390	.....
11	1,310	793	2,540	182	562	917	354	.....
12	1,790	850	2,530	173	438	909	328	.....
13	1,800	862	2,530	163	485	870	328	.....
14	1,850	890	2,520	154	510	831	320	.....
15	1,950	901	2,510	150	513	756	315	.....
16	3,000	905	2,500	150	458	701	320	.....
17	3,400	862	2,500	150	429	578	341	.....
18	3,730	1,010	1,920	150	423	482	341	.....
19	3,580	1,230	1,780	148	373	482	368	.....
20	3,370	1,170	1,480	148	331	452	368	.....
21	3,160	1,110	1,190	150	289	429	368	.....
22	3,160	1,230	993	150	328	368	354	.....
23	2,980	1,320	811	142	289	328	341	.....
24	2,760	1,250	679	150	276	315	328	.....
25	2,530	909	647	158	274	328	289	.....
26	2,240	909	581	160	331	302	289	.....
27	2,050	1,010	476	191	382	289	284	.....
28	1,900	1,590	443	250	458	315	269	.....
29	1,720	1,540	406	259	426	438	264	.....
30	1,630	1,190	390	240	423	409	279	.....
31	.....	1,030	.....	513	423	.....	289	.....

NOTE.—Daily discharge computed from a rating curve well defined below 3,000 second-feet. Discharge estimated Apr. 1 to 7 because of backwater from ice and Apr. 12 to 20 and June 10 to 17 because of backwater from log jams below. Discharge Nov. 10 to Dec. 31 estimated, because of ice, from one discharge measurement, gage observer's notes, and climatologic records. Mean discharge Nov. 10 to 30 estimated 175 second-feet, varying from about 140 to 280 second-feet. Mean discharge Dec. 1 to 31 estimated 145 second-feet, varying from about 110 to 156 second-feet.

Monthly discharge of Little Fork River at Little Fork, Minn., for 1911.

[Drainage area, 1,720 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
April	3,730	900	2,100	1.22	1.36	B.
May	1,590	719	1,080	.628	.72	A.
June	2,610	390	1,680	.977	1.09	B.
July	513	142	212	.123	.14	A.
August	793	274	492	.286	.33	A.
September	917	289	529	.308	.34	A.
October	482	264	356	.207	.24	A.
November	289	.....	209	.122	.14	C.
December	.....	.....	145	.084	.10	C.

NOTE.—See footnotes to table of daily discharge.

BIG FORK RIVER AT BIG FALLS, MINN.

Location.—At Big Falls, about 500 feet below the lower end of the rapids.

Records available.—August 27, 1909, to December 31, 1911.

Drainage area.—1,320 square miles.

Gage.—Vertical staff. The gage was originally located at the Minnesota and International bridge above the falls, but jams at that point caused so much trouble that on June 10, 1911, the station was moved to its present location, the new gage being set to read approximately 1 foot lower than the old gage. Gage heights for 1911 have been referred to the present gage by means of readings taken at both gages.

Channel.—Unstable by reason of log jams forming below the gage.

Discharge measurements.—From a car and cable one-fourth mile below the gage.

Accuracy.—Although the new location is better than the old, it is not free from backwater caused by log jams. During the greater part of 1911 a log jam on the opposite side of the river and a short distance below extended about half way across the river and undoubtedly created some backwater at the gage. Estimates of discharge for 1911 are withheld for further data.

Discharge measurements of Big Fork River at Big Falls, Minn., 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
June 10	S. B. Soulé	[a] 7.07	1,760
12	do	[b] 3.89	193
Dec. 13[c]	do	2.65	65.5

[a] Lower gage reading 6.07, measurement made from M. & I. Ry. bridge.
[b] Lower gage reading 2.99, measurement made at cable section.
[c] Complete ice cover, measured at cable section. Average thickness of ice, 0.7 foot.

Daily gage height, in feet, of Big Fork River at Big Falls, Minn., for 1911.

[G. T. Robinson, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.94	4.89	3.73	3.20	3.70	4.05	4.10	3.0
2	.....	4.89	4.98	3.58	4.00	3.70	4.15	3.90	.....
3	.....	4.79	5.18	3.56	4.45	3.68	4.15	3.75	.....
4	.....	4.65	5.47	3.47	4.50	3.85	4.18	3.60	.....
5	.....	4.70	5.47	3.44	4.45	3.95	4.20	3.80	.....
6	.....	4.55	5.52	3.34	4.35	4.05	4.22	4.00	.....
7	.....	4.31	5.32	3.29	4.40	4.15	4.28	4.20	3.0
8	.....	4.21	5.52	3.20	4.35	4.20	4.25	4.22	.....
9	.....	4.21	5.76	3.10	4.25	4.15	4.20	4.22	.....
10	.....	4.12	6.14	3.00	4.15	4.25	4.18	4.28	.....
11	.....	4.16	6.30	2.91	4.05	4.35	4.15	4.12	3.0
12	.....	4.31	6.30	3.00	3.85	4.25	4.20	4.05	.....
13	.....	4.36	6.30	2.95	3.75	4.20	4.15	4.00	2.65
14	.....	4.31	5.90	2.85	3.70	4.15	4.10	3.65	2.65
15	.....	4.31	5.50	2.75	3.65	4.05	4.12	3.40	.....
16	.....	4.40	5.20	2.80	3.60	4.00	4.20	3.4	.....
17	.....	4.36	5.10	2.75	3.55	3.95	4.15	.....	.....
18	.....	4.45	5.10	2.72	3.45	3.85	4.20	.....	2.6
19	5.57	4.50	5.00	2.75	3.35	3.80	4.30	.....	.....
20	5.47	4.40	4.30	2.85	3.25	3.85	4.35	.....	.....
21	5.52	4.70	4.25	2.80	3.60	3.80	4.38	2.8	2.6
22	5.57	4.70	4.10	2.72	3.50	3.80	4.40	.....	.....
23	5.66	4.89	4.05	2.75	3.50	3.85	4.40	3.0	.....
24	5.57	4.70	4.60	2.80	3.45	3.80	4.38	.....	.....
25	5.47	4.65	4.36	2.85	3.40	3.80	4.35	.....	2.8
26	5.37	4.50	4.36	2.85	3.45	3.85	4.28	.....	.....
27	5.32	4.40	4.02	2.90	3.65	3.90	4.25	2.9	.....
28	5.32	4.65	3.92	2.88	3.90	3.95	4.22	.....	2.8
29	5.13	5.18	3.87	2.85	4.05	4.00	4.20	.....	.....
30	5.03	5.18	3.82	2.80	4.00	4.05	4.22	3.0	.....
31	.....	5.08	.....	2.82	3.85	.....	4.20	.....	.....

NOTE.—These gage heights are all referred to a gage established June 10, those prior to that date having been reduced by simultaneous readings of the two gages.

VERMILION RIVER BELOW LAKE VERMILION, NEAR TOWER, MINN.

Location.—Just below the dam at the outlet of Lake Vermilion in section 2, T. 63 N., R. 17 W., in St. Louis County, 4 miles above the mouth of Twomile Creek, which enters from the west.

Records available.—May 17, 1911, to December 31, 1911.

Drainage area.—507 square miles.

Gage.—Vertical staff.

Channel.—Probably permanent.

Discharge measurements.—Made by means of car and cable just above the gage section.

Winter flow.—Owing to the heavy fall at the gage section, amounting to 20 feet in 200 yards, there is little or no backwater from ice during the winter months.

Accuracy.—Conditions are favorable for fairly accurate results, the only uncertainty being some inaccuracy in the discharge measurements owing to the very rocky section.

Discharge measurements of Vermilion River below Lake Vermilion, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
May 31	C. J. Emerson	1.94	[a] 518
June 30	do	1.88	486
July 30	S. B. Soulé	1.32	262
Oct. 8	do	0.93	173

[a] With soundings corrected by measurement of June 30.

Daily gage height, in feet, of Vermilion River below Lake Vermilion, Minn., for 1911.

[Clarence M. Everett, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.90	1.90	1.35	0.90	0.85	0.71	0.70
2	.....	1.90	1.85	1.35	.90	.85	.68	.70
3	.....	1.95	1.80	1.33	.90	.84	.66	.70
4	.....	1.90	1.75	1.33	.90	.84	.64	.70
5	.....	1.90	1.73	1.32	.90	.85	.62	.70
6	.....	1.90	1.72	1.32	1.00	.85	.60	.70
7	.....	1.90	1.71	1.33	1.50	.85	.60	.70
8	.....	1.95	1.60	1.32	1.50	.84	.60	70
9	.....	1.95	1.60	1.32	1.50	.84	.60	.70
10	.....	2.05	1.50	1.31	1.30	.84	.60	.70
11	.....	2.03	1.45	1.31	1.20	.84	.60	.70
12	.....	2.01	1.40	1.30	1.10	.85	.60	.70
13	.....	2.00	1.35	1.30	1.10	.84	.60	.70
14	.....	2.00	1.33	1.25	1.10	.84	.60	.70
15	.....	2.00	1.30	1.25	1.10	.84	.60	.70
16	.....	1.95	1.35	1.20	1.10	.84	.60	.70
17	1.95	1.92	1.35	1.20	1.00	.85	.62	.70
18	2.00	1.91	1.30	1.20	1.00	.86	.63	.70
19	2.10	1.90	1.30	1.25	.98	.86	.65	.70
20	2.00	2.15	1.20	1.25	.96	.85	.68	.70
21	1.95	2.10	1.10	1.25	.94	.84	.70	.70
22	2.00	2.05	1.30	1.22	.90	.83	.70	.70
23	2.05	2.05	1.30	1.20	.90	.82	.70	.70
24	2.00	2.00	1.30	1.10	.90	.80	.70	.70
25	1.95	2.00	1.30	1.10	.90	.78	.70	.70
26	1.90	1.95	1.35	1.00	.90	.76	.70	.70
27	1.90	1.95	1.35	1.00	.90	.74	.70	.70
28	1.90	1.90	1.35	1.00	.88	.72	.70	.70
29	1.90	1.90	1.32	1.00	.86	.71	.70	.70
30	1.90	1.90	1.32	.90	.85	.70	.70	.70
31	1.95	.....	1.32	.90	.....	.70	.....	.70

Daily discharge, in second-feet, of Vermilion River below Lake Vermilion, Minn., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	490	490	272	167	158	132	130
2	.....	490	466	272	167	158	127	130
3	.....	515	442	266	167	156	124	130
4	.....	490	420	266	167	156	120	130
5	.....	490	411	263	167	158	117	130
6	.....	490	407	263	187	158	114	130
7	.....	490	402	266	321	158	114	130
8	.....	515	358	263	321	156	114	130
9	.....	515	358	263	321	156	114	130
10	.....	568	321	260	257	156	114	130
11	.....	556	304	260	231	156	114	130
12	.....	546	287	257	208	158	114	130
13	.....	540	272	257	208	156	114	130
14	.....	540	266	244	208	156	114	130
15	.....	540	257	244	208	156	114	130
16	.....	515	272	231	208	156	114	130
17	515	500	272	231	187	158	117	130
18	540	495	257	231	187	159	119	130
19	595	490	257	244	183	159	122	130
20	540	622	231	244	179	158	127	130
21	515	595	208	244	175	156	130	130
22	540	568	257	236	167	154	130	130
23	568	568	257	231	167	152	130	130
24	540	540	257	208	167	148	130	130
25	515	540	257	208	167	144	130	130
26	490	515	272	187	167	141	130	130
27	490	515	272	187	167	137	130	130
28	490	490	272	187	163	134	130	130
29	490	490	263	187	159	132	130	130
30	490	490	263	167	158	130	130	130
31	515	.....	263	167	.....	130	.....	130

NOTE.—Discharge computed from a well-defined rating curve.

Monthly discharge of Vermilion River below Lake Vermilion, Minn., for 1911.

[Drainage area, 507 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
May 17-31	595	490	522	1.03	0.57	A.
June	622	490	524	1.04	1.16	A.
July	490	208	309	.609	.70	A.
August	272	167	236	.466	.54	A.
September	321	158	197	.389	.43	A.
October	159	130	152	.300	.35	B.
November	132	114	122	.241	.27	B.
December	130	130	130	.256	.30	B

UPPER MISSISSIPPI RIVER DRAINAGE BASINS.

MISSISSIPPI RIVER ABOVE SANDY RIVER, NEAR LIBBY, MINN.

Location.—A short distance above the mouth of Sandy River in sec. 25, T. 50 N., R. 24 W., near Libby post office in Aitkin County.

Records available.—September 1, 1895, to December 31, 1911.

Drainage area.—4,510 square miles.

Gage.—Vertical staff.

Discharge measurements.—Made by an employee of the United States Engineer Corps stationed near by at Sandy Lake dam.

Cooperation.—This station is maintained by the United States Engineer Corps for the purpose of determining the flow of the river above Sandy Lake reservoir.

Daily discharge, in second-feet, of Mississippi River above Sandy River, Minn., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	652	709	720	1,088	1,116	1,917	2,327	2,310	2,084	1,951	1,270	699
2	653	709	725	1,091	1,211	1,963	2,318	2,258	2,136	1,890	1,283	690
3	653	708	731	1,094	1,305	2,009	2,309	2,206	2,187	1,829	1,296	681
4	657	708	737	1,097	1,400	2,056	2,300	2,154	2,239	1,768	1,308	672
5	658	708	742	1,100	1,494	2,102	2,291	2,103	2,290	1,707	1,321	663
6	660	707	748	1,102	1,589	2,148	2,282	2,051	2,342	1,646	1,333	654
7	663	707	754	1,105	1,684	2,195	2,274	2,000	2,393	1,585	1,346	645
8	658	707	760	1,108	1,633	2,242	2,264	1,948	2,445	1,523	1,359	636
9	653	706	766	1,111	1,582	2,205	2,321	1,896	2,496	1,526	1,372	627
10	648	706	772	1,132	1,531	2,167	2,378	1,843	2,548	1,529	1,341	621
11	645	706	778	1,153	1,480	2,130	2,436	1,802	2,599	1,532	1,310	614
12	640	705	784	1,175	1,429	2,092	2,493	1,761	2,651	1,535	1,278	608
13	637	700	792	1,196	1,378	2,054	2,551	1,720	2,703	1,538	1,246	601
14	635	694	800	1,217	1,325	2,017	2,608	1,678	2,628	1,541	1,215	595
15	639	688	807	1,239	1,455	1,979	2,666	1,637	2,552	1,544	1,183	588
16	643	683	815	1,260	1,585	1,940	2,723	1,595	2,477	1,547	1,152	582
17	648	676	823	1,282	1,715	1,869	2,781	1,554	2,401	1,549	1,120	576
18	652	670	830	1,303	1,845	1,798	2,838	1,513	2,326	1,534	1,089	592
19	657	665	838	1,325	1,975	1,727	2,895	1,472	2,250	1,519	1,057	609
20	661	670	858	1,346	2,105	1,655	2,858	1,439	2,175	1,504	1,026	625
21	665	676	879	1,368	2,235	1,584	2,821	1,519	2,099	1,489	994	642
22	669	682	899	1,390	2,199	1,513	2,784	1,609	2,023	1,474	963	658
23	673	687	920	1,413	2,163	1,615	2,747	1,698	2,022	1,459	931	674
24	677	693	941	1,358	2,126	1,718	2,711	1,787	2,020	1,443	900	690
25	681	698	980	1,302	2,090	1,820	2,675	1,876	2,019	1,417	868	692
26	686	704	1,000	1,246	2,054	1,923	2,623	1,912	2,017	1,391	837	695
27	690	709	1,022	1,191	2,017	2,025	2,570	1,928	2,016	1,365	805	698
28	695	714	1,040	1,135	1,981	2,128	2,518	1,954	2,014	1,339	774	700
29	700	.....	1,058	1,079	1,944	2,232	2,465	1,981	2,013	1,312	742	703
30	705	.....	1,072	1,022	1,908	2,335	2,413	2,007	2,012	1.286	707	706
31	710	.....	1,085	.....	1,871	.....	2,361	2,033	.....	1,258	.....	709

NOTE.—Taken from unpublished records of the United States Engineer Corps at St. Paul. Determinations of daily discharge based almost directly on frequent discharge measurements.

Monthly discharge of Mississippi River above Sandy River, Minn., for 1911.

[Drainage area, 4,510 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in millions of cubic-feet.
January	710	635	663	0.147	0.17	1,780
February	714	665	696	.154	.16	1,680
March	1,085	720	854	.189	.22	2,290
April	1,413	1,022	1,200	.266	.30	3,110
May	2,235	1,116	1,720	.381	.44	4,610
June	2,335	1,513	1,970	.437	.49	5,110
July	2,895	2,264	2,540	.563	.65	6,800
August	2,310	1,439	1,850	.410	.47	4,950
September	2,703	2,012	2,270	.503	.56	5,880
October	1,951	1,258	1,530	.339	.39	4,100
November	1,372	707	1,110	.246	.27	2,880
December	709	576	650	.144	.17	1,740
The year	2,895	576	1,430	.317	4.29	44,900

NOTE.—Above table computed by engineers of the United States Geological Survey from records of daily discharge furnished by the United States Engineer Corps.

MISSISSIPPI RIVER AT ANOKA, MINN.

Location.—At highway bridge connecting Anoka with Champlain, a short distance above the mouth of Rum River.

Records available.—November 3, 1896, to September 10, 1897 (United States Engineer records); May 8, 1905, to December 31, 1911.

Drainage area.—17,100 square miles.

Gage.—Staff gage prior to 1909, now a chain gage; datum, unchanged since station established, is the same as that used by the United States Engineer Corps in 1896 and 1897.

Channel.—Practically permanent. Control temporarily changed for a few days at times by log jams.

Discharge measurements.—Made from the bridge.

Winter flow.—The river is frozen from December to March, inclusive, and regular observations are discontinued. The monthly discharge for this period is based on the records of flow of the St. Anthony Falls Water Power Co., Minneapolis, and of the United States Engineer Corps records at Lock and Dam 2 below Minneapolis, an allowance being made for the increase in flow between the different points.

Regulation.—The nearest dam is located at Minneapolis, but on account of the fall between the two points its influence does not extend to the Anoka station. The first dam above Anoka is at St. Cloud. The flow of the river is controlled by Government dams on the upper river for the purpose of increasing the low-water open-season flow in the interest of navigation. Although the river is used extensively for log driving, there is very little backwater from log jams forming below the station, except for a few days at a time.

Accuracy.—Although no measurements were made during 1907 and 1908, those made subsequently indicate that there has been no change in the discharge rating curve as developed in 1897, 1905, and 1906, and therefore it can be applied to all gage heights since the establishment of the station. This permanence of conditions indicates that the records of flow are reliable.

Discharge measurements of Mississippi River at Anoka, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
July 1	S. B. Soulé	0.12	4,650
25	do	[a] .21	3,770
Aug. 25	do	− .46	3,210

[a] Backwater from log jam.

Daily gage height, in feet, of Mississippi River at Anoka, Minn., for 1911.

[Bernard J. Witte, jr., observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		−0.57	−0.30	0.27	0.14		−0.38	0.10	−0.20
2		− .59	− .25	.40	.13	0.45	− .42	− .10	− .18
3		− .61	− .25	.45	− .02	.70	− .42	.00	− .20
4		− .60	− .30	.70	.18	.88	− .46	.08	− .40
5		− .50	− .37	.65	.08	.80	− .36	.12	− .35
6		− .55	− .65	.65	.10	.85	− .40	.10	− .20
7		− .60	− .74	.45	.08	.00	− .10	.15	− .18
8		− .53	− .65	.75	.08	− .02	.10	.15	− .20
9		− .55	− .58	.85		− .15	.10	.15	− .20
10		− .55	− .50	.67	− .03	− .08	.24	10	− .30

Daily gage height, in feet, of Mississippi River at Anoka, Minn., for 1911 —Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
11	.....	−0.55	−0.50	0.43	−0.02	−0.20	0.15	0.10	−0.40
12	.....	− .63	.....	.25	− .18	− .25	.28	.15	− .10
13	.....	− .45	− .40	.35	− .02	− .22	.25	.02	− .40
14	.....	− .50	.....	.15	− .17	− .30	.58	.02	− .40
15	.....	− .43	− .14	.05	− .17	− .25	.58	.08	.30
16	.....	− .34	.20	.15	.....	− .25	.55	.00	.40
17	.....	− .25	.23	.00	− .42	− .25	.52	.20	.20
18	.....	.07	.30	.15	− .40	− .32	.50	.00	.30
19	.....	− .03	.43	.15	− .30	− .38	.50	.20	.....
20	−0.36	+ .27	.45	.10	− .22	− .32	.38	.20	.....
21	− .42	− .10	.....	.10	− .10	− .42	.70	.22	.....
22	− .50	− .05	.83	.13	− .07	.34	.48	.25	.....
23	− .50	− .30	.97	.00	.08	.50	.40	.18	.....
24	− .50	− .25	1.00	− .05	.03	.45	.50	.18	.....
25	− .59	− .25	.87	− .25	.03	− .42	.60	.10	.....
26	− .56	− .30	.70	− .13	.02	− .50	.72	.17	.....
27	− .58	− .25	.60	− .05	.50	− .55	.55	.00	.....
28	− .49	− .17	.50	.00	.50	− .55	.50	.10	.....
29	− .55	− .20	.47	.25	.....	− .55	.48	− .10	.....
30	− .63	− .30	.30	.15	.....	− .50	.48	− .10	.....
31	− .71	.....	.15	.....	.....	− .42	.....	− .05	.....

NOTE.—Ice present Jan. 1 to Mar. 19 and Nov. 14 to Dec. 31. Gage heights Nov. 14 to 18 are to top of ice. Backwater from log jams July 21 to Aug. 6 and Sept. 10 to 30.

Daily discharge, in second-feet, of Mississippi River at Anoka, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1,790	3,080	3,520	4,660	4,380	3,870	3,380	4,300	3,700
2	1,860	3,050	3,600	4,960	4,360	3,740	3,310	3,880	3,730
3	1,750	3,020	3,600	5,080	4,040	4,010	3,310	4,080	3,700
4	1,770	3,040	3,520	5,720	4,470	3,970	3,250	4,250	3,340
5	1,460	3,180	3,400	5,580	4,250	4,150	3,410	4,340	3,430
6	1,920	3,110	2,960	5,580	4,300	4,100	3,340	4,300	3,700
7	1,860	3,040	2,840	5,080	4,250	4,080	3,880	4,400	3,730
8	1,820	3,140	2,960	5,870	4,250	4,040	4,300	4,400	3,700
9	2,140	3,110	3,060	6,180	4,140	3,790	4,300	4,400	3,700
10	2,280	3,110	3,180	5,640	4,020	3,920	4,300	4,300	3,520
11	2,000	3,110	3,180	5,030	4,040	3,700	4,310	4,300	3,340
12	1,920	2,990	3,260	4,620	3,730	3,600	4,300	4,400	3,340
13	2,550	3,260	3,340	4,840	4,040	3,660	4,100	4,130	3,340
14	2,540	3,180	3,580	4,400	3,750	3,520	4,090	4,130	3,200
15	1,960	3,300	3,810	4,190	3,750	3,600	4,260	4,340	3,100
16	1,700	3,450	4,510	4,400	3,530	3,600	4,390	4,080	3,100
17	2,220	3,600	4,580	4,080	3,310	3,600	4,300	4,510	3,000
18	2,610	4,230	4,730	4,400	3,340	3,480	4,300	4,080	3,000
19	2,410	4,020	5,030	4,400	3,520	3,380	4,350	4,510	2,900
20	3,410	4,660	5,080	4,300	3,660	3,480	4,250	4,510	2,900
21	3,310	3,880	5,600	4,300	3,460	3,310	4,250	4,550	2,900
22	3,180	3,980	6,120	4,360	3,690	3,450	4,490	4,620	2,800
23	3,180	3,520	6,580	4,080	3,810	3,180	4,350	4,470	2,800
24	3,180	3,600	6,680	3,980	3,570	3,260	4,300	4,470	2,800
25	3,050	3,600	6,240	3,600	3,810	3,310	4,170	4,300	2,700
26	3,100	3,520	5,720	3,830	3,470	3,180	4,170	4,450	2,700
27	3,060	3,600	5,450	3,980	3,690	3,110	4,300	4,080	2,600
28	3,200	3,750	5,200	4,080	4,210	3,110	4,350	4,300	2,600
29	3,110	3,700	5,130	4,620	4,070	3,110	4,490	3,880	2,500
30	2,990	3,520	4,730	4,400	3,800	3,180	4,700	3,880	2,500
31	2,880	.....	4,400	.....	3,540	3,310	.....	3,980	.....

NOTE.—Daily discharge computed from a well-defined rating curve. From Mar. 1 to 19, July 21 to Aug. 6, Sept. 9 to 30, Nov. 12, and from Nov. 14 to 30 the discharge has been estimated on account of obstructed channel. Discharge has been estimated for days of missing gage heights.

Monthly discharge of Mississippi River at Anoka, Minn., for 1911.

[Drainage area, 17,100 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	[a] 1,670	0.098	0.11	C.
February	.....	.....	[a] 1,700	.100	.10	C.
March	3,410	[b] 1,460	2,460	.144	.17	B.
April	4,660	2,990	3,440	.201	.22	A.
May	6,680	2,840	4,370	.256	.30	A.
June	6,180	3,600	4,670	.273	.30	A.
July	4,470	3,310	3,880	.227	.26	B.
August	[b] 4,150	3,110	3,570	.209	.24	A.
September	4,700	3,250	4,100	.240	.27	B.
October	4,620	3,880	4,280	.250	.29	A.
November	3,700	[b] 2,500	3,150	.184	.21	B.
December	.....	.....	[a] 2,120	.124	.14	B.
The year	6,680	.....	3,290	.192	2.58	

[a] Estimated from the records of the United States Engineer Corps at Lock and Dam 2, near Minneapolis, and a comparison of the discharge of the Rum at Cambridge.
[b] Estimated.

NOTE.—See footnotes to tables of daily gage height and daily discharge.

MISSISSIPPI RIVER AT ST. PAUL, MINN.

Location.—Near foot of Jackson Street, St. Paul; 6 miles below the mouth of Minnesota River.

Records available.—Gage heights by United States Signal Service (later United States Weather Bureau) 1873 to 1911. Many discharge measurements by United States Engineer Corps prior to 1900. Measurements made by United States Geological Survey 1909 to 1911.

Drainage area.—35,700 square miles.

Gage.—Vertical staff at upper end of the Diamond Joe Line wharf at the foot of Jackson Street, St. Paul; read once a day; datum unchanged. At the lower end of the same dock is the United States Engineer Corps gage, datum of which is 0.5 feet higher than that of the Weather Bureau gage, to which all the data following are referred.

Channel.—Somewhat shifting from year to year.

Discharge measurements.—Made from the Chicago, St. Paul, Minneapolis & Omaha Railway bridge, 2 miles above the station.

Regulation.—The river is controlled to a certain extent by the Government reservoirs on the headwaters, but the effect of these reservoirs is felt very gradually at St. Paul. The nearest dam is at Minneapolis, and it is possible that the shutting of the wheel gates at that point may cause some daily fluctuations of stage at St. Paul during extreme low water.

Winter flow.—From December to March the river is frozen and the open-channel rating curve is not applicable. Monthly estimates of flow for this period are based on the records of the St. Anthony Falls Water Power Co. at Minneapolis and the records of the United States Engineer Corps at Lock and Dam 2 below Minneapolis—an allowance being made for the flow of Minnesota River.

Maximum and minimum flow.—The highest recorded discharge occurred July 22, 1867, and amounted to 117,000 second-feet. Since 1891 the highest discharge has been 80,800 second-feet. The winter flow has fallen nearly as low as 1,000 second-feet.

Accuracy.—As the Weather Bureau gage is read once a day, the recorded mean gage height for the day may be somewhat in error, although occasional additional readings have shown this was not serious, due largely to the natural storage of the river channel between the Minneapolis dam and St. Paul. Previous to 1900 the United States Engineer Corps made many discharge measurements at St. Paul, the results of which are published by the Mississippi River Commission. Although the base data for estimating the daily flow of the river are available for years prior to 1892, the reservoir system was not then in complete operation, and as this system has had marked influence on the regimen of the river, it is evident that the earlier records have lost much of their value as indications of probable future flow.

Discharge measurements of Mississippi River at St. Paul, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 18	C. R. Adams	−0.55	[a] 2,150
May 25	C. J. Emerson	3.30	8,620
June 3	Follansbee and Soulé	2.44	6,960
July 8	Soulé and Orbeck	1.60	5,070
Aug. 23	S. B. Soulé	0.81	3,780
Oct. 24	C. J. Emerson	4.00	9,460

[a] River open.

Daily gage height, in feet, of Mississippi River at St. Paul, Minn., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1			−0.05	0.6	0.7	1.9	1.7	1.2	0.6	1.5	2.3	
2				.7	1.1	1.9	1.6	1.1	.6	1.5	2.1	1.2
3	0.7	0.1	− .55	.5	1.1	2.4	1.5	1.3	.8	1.4	2.0	
4			− .4	.6	.9	2.6	1.6	1.2	.5	1.7	1.7	
5			− .4	.7	.8	2.5	1.6	1.4	.9	1.9	1.5	
6	.7		− .3	1.0	.8	2.4	1.7	1.4	.9	2.0	1.1	
7		.4	− .2	.7	.8	2.5	1.6	1.7	1.0	4.3	1.3	
8			− .1	.8	.2	2.0	1.6	1.6	1.0	4.8	1.4	
9			.0	.8	.6	2.3	1.6	1.5	1.2	4.5	1.5	.1
10	.7	.3	.3	.5	.5	2.4	1.2	1.4	1.3	4.4	1.6	
11			.2	.7	.6	2.2	1.4	1.4	1.3	4.1	1.5	
12			.1	.8	.7	2.0	1.2	1.1	1.3	3.8		.2
13	.5		.2	.9	.9	2.1	1.2	1.1	1.2	3.7		
14		.7	.5	1.0	.9	2.0	1.1	1.1	1.1	3.5		
15				1.2	1.5	1.9	1.0	1.3	1.3	3.5		.4
16				1.2	1.5	1.8	1.1	1.6	1.5	3.4		
17	.4	− .5	− .2	1.0	1.9	2.0	.8	1.5	1.4	3.5	2.9	
18		− .6		1.4	1.8	1.9	.9	1.3	1.4	3.9		
19			.8	1.8	2.0	1.7	1.0	1.3	1.4	4.2		.4
20	.5		.7	1.7	2.2	1.9	.8	1.2	1.3	4.3		
21		.3	1.2	2.0	2.4	1.9	.7	1.0	1.3	4.1		.4
22			1.3	1.8	2.6	1.7	.9	1.0	1.5	4.1	2.1	
23			1.0	1.6	3.0	1.7	1.0	.9	1.4	4.2		
24		− .7	.8	1.1	3.2	1.6	.8	.8	1.3	4.1		
25	.6	− .4	.7	1.3	3.2	1.6	1.0	.7	1.2	3.8		
26		− .6	.7	1.4	3.1	1.1	.8	.7	1.2	3.6		.6
27	.6	− .45	.7	1.2	2.9	1.4	.9	.6	1.3	3.4	1.8	
28		.15	.8	1.1	2.6	1.2	1.3	.4	1.3	3.2		
29			.8	1.2	2.3	1.4	1.2	.5	1.5	2.9		
30			.8	1.3	2.3	1.6	1.1	.5	1.6	2.7		
31	.7		.6		2.3		.9	.5		2.4		

NOTE.—Ice present Jan. 1 to Feb. 28 and about Nov. 7 to Dec. 31.

Daily discharge, in second-feet, of Mississippi River at St. Paul, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	2,710	3,530	3,670	5,720	5,090	4,370	3,650	4,790	6,050
2	2,400	3,670	4,260	5,720	4,940	4,240	3,650	4,790	5,720
3	2,140	3,400	4,260	6,730	4,790	4,510	3,870	4,650	5,560
4	2,310	3,530	3,950	7,150	4,940	4,370	3,540	5,090	5,090
5	2,310	3,670	3,810	6,940	4,940	4,650	3,990	5,400	4,790
6	2,420	4,100	3,810	6,730	5,090	4,650	3,990	5,560	4,240
7	2,530	3,670	3,810	6,940	4,940	5,090	4,110	10,300	.....
8	2,650	3,810	3,010	5,920	4,940	4,940	4,110	11,800	.....
9	2,770	3,810	3,530	6,520	4,940	4,790	4,370	10,900	.....
10	3,140	3,400	3,400	6,730	4,370	4,650	4,510	10,600	.....
11	3,010	3,670	3,530	6,320	4,650	4,650	4,510	9,780	.....
12	2,890	3,810	3,670	5,920	4,370	4,240	4,510	9,030	.....
13	3,010	3,950	3,950	6,120	4,370	4,240	4,370	8,790	.....
14	3,400	4,100	3,950	5,920	4,240	4,240	4,240	8,340	.....
15	3,300	4,430	4,960	5,720	4,110	4,510	4,510	8,340	.....
16	2,900	4,430	4,960	5,530	4,240	4,940	4,790	8,120	.....
17	2,530	4,100	5,720	5,920	3,870	4,790	4,650	8,340	.....
18	3,200	4,780	5,530	5,720	3,990	4,510	4,650	9,270	.....
19	3,810	5,530	5,920	5,340	4,110	4,510	4,650	10,000	.....
20	3,670	5,340	6,320	5,720	3,870	4,370	4,510	10,300	.....
21	4,430	5,920	6,730	5,720	3,760	4,110	4,510	9,780	.....
22	4,600	5,530	7,150	5,340	3,990	4,110	4,790	9,780	.....
23	4,100	5,150	8,010	5,340	4,110	3,990	4,650	10,000	.....
24	3,810	4,260	8,450	5,150	3,870	3,870	4,510	9,780	.....
25	3,670	4,600	8,450	5,150	4,110	3,760	4,370	9,030	.....
26	3,670	4,780	8,230	4,160	3,870	3,760	4,370	8,560	.....
27	3,670	4,430	7,790	4,650	3,990	3,650	4,510	8,120	.....
28	3,810	4,260	7,150	4,300	4,510	3,430	4,510	7,700	.....
29	3,810	4,430	6,520	4,620	4,370	3,540	4,790	7,110	.....
30	3,810	4,600	6,520	4,950	4,240	3,540	4,940	6,740	.....
31	3,530	.....	6,520	.....	3,990	3,540	.....	6,220	.....

NOTE.—Daily discharge computed from well-defined rating curve which was applied indirectly Mar. 1 to June 30, owing to shifting channel. Discharge Nov. 7 to 30 estimated because of ice. Mean discharge about 3,840 second-feet, ranging from about 3,600 to 4,000 second-feet.

Monthly discharge of Mississippi River at St. Paul, Minn., for 1911.

[Drainage area, 35,700 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	[a] 1,960	0.055	0.06	B.
February	.....	.....	[a] 2,060	.058	.06	B.
March	4,600	2,140	3,230	.090	.10	B.
April	5,920	3,400	4,290	.120	.13	B.
May	8,450	3,010	5,400	.151	.17	B.
June	7,150	4,160	5,760	.161	.18	B.
July	5,090	3,760	4,340	.122	.14	A.
August	5,090	3,430	4,280	.120	.14	A.
September	4,940	3,540	4,370	.122	.14	A.
October	11,800	4,650	8,290	.232	.27	A.
November	6,050	.....	4,120	.115	.13	B.
December	.....	.....	[a] 3,150	.088	.10	B.
The year	.....	.....	4,290	.120	1.62	

[a] Estimated from United States Engineer Corps records at Lock and Dam No. 2 near Minneapolis, an allowance (based on the Mankato records) being made for the flow of Minnesota River.

NOTE.—See footnotes to tables of daily gage height and daily discharge.

SANDY RIVER BELOW SANDY LAKE RESERVOIR, MINN.

Location.—At the Sandy Lake dam near Libby post office, in Aitkin County, 1 mile above the mouth of Sandy River.

Records available.—July 7, 1893, to December 31, 1911.

Area of reservoir behind dam.—At low stage 8 square miles, at high stage 16.5 square miles; these areas, with a range of 9.4 feet, give a capacity of 3,127,900,000 cubic feet.

Discharge.—The discharge over the dam is computed from the flow through the openings and frequent discharge measurements made by an employee who resides near the dam. At extreme flood stages the Mississippi drowns at the dam and fills Sandy Lake Reservoir as much as 3 feet higher than was intended. If the Mississippi is at fairly high stage and the dam is open there is frequently a considerable reverse flow into the reservoir but the amount of this flow has not been computed.

Cooperation.—The station is maintained by the United States Engineer Corps for the purpose of measuring the flow from the Sandy Lake reservoir, which is one unit in the Government reservoir system of the headwaters of the Mississippi.

Daily discharge, in second-feet, of Sandy River below Sandy Lake reservoir, Minn., for 1911.

[0=No flow from reservoir.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5	5	5	5	5	284	152	5	0	5	75	10
2	5	5	5	5	5	283	122	5	5	5	75	10
3	5	5	5	5	5	282	92	5	5	5	75	10
4	5	5	5	5	5	292	61	5	0	5	50	10
5	5	5	5	5	5	301	30	5	0	5	50	10
6	5	5	5	5	5	311	00	5	0	5	50	10
7	5	5	5	5	5	321	50	5	0	5	50	10
8	5	5	5	5	5	331	50	5	0	5	50	10
9	5	5	5	5	242	328	100	5	0	5	50	10
10	5	5	5	5	303	325	75	5	0	5	50	10
11	5	5	5	5	300	321	5	5	0	5	50	10
12	5	5	5	5	296	318	5	5	0	5	50	10
13	5	5	5	5	291	315	5	5	0	5	50	10
14	5	5	5	5	287	312	5	5	0	268	50	10
15	5	5	5	5	294	308	0	5	0	275	10	10
16	5	5	5	5	301	305	0	5	0	282	10	10
17	5	5	5	5	308	303	0	300	0	281	10	10
18	5	5	5	5	316	301	0	307	5	272	10	10
19	5	5	5	5	324	300	0	296	5	263	10	10
20	5	5	5	5	328	467	0	285	5	255	10	10
21	5	5	5	5	332	475	0	274	5	225	10	10
22	5	5	5	5	283	483	0	263	5	195	10	10
23	5	5	5	5	104	492	0	251	5	166	10	10
24	5	5	5	5	109	501	0	239	5	162	10	10
25	5	5	5	5	114	448	0	227	5	157	10	10
26	5	5	5	5	118	395	0	198	5	153	10	10
27	5	5	5	5	123	342	0	169	5	148	10	10
28	5	5	5	5	111	289	0	140	5	144	10	10
29	5	.....	5	5	100	236	0	110	5	139	10	10
30	5	.....	5	5	293	182	0	80	5	134	10	10
31	5	.....	5	.....	285	.....	0	50	.....	129	.....	10

NOTE.—Daily discharge compiled from unpublished records in the United States Engineer Office at St. Paul.

Monthly overflow from Sandy Lake reservoir, Minn., for 1911.

Month.	Discharge in second-feet.			Run-off (in acre-feet).
	Maximum.	Minimum.	Mean.	
January	5	5	5.0	13.4
February	5	5	5.0	12.1
March	5	5	5.0	13.4
April	5	5	5.0	13.0
May	332	5	181	485
June	501	182	338	876
July	152	0	24.3	65.1
August	307	5	105	281
September	5	0	2.5	6.48
October	282	5	120	321
November	75	10	31.2	80.9
December	10	10	10.0	26.8
The year	501	0	69.6	2,190

NOTE.—Estimates computed by engineers of the United States Geological Survey from unpublished records in the United States Engineer Office at St. Paul.

PINE RIVER BELOW PINE RIVER RESERVOIR, MINN.

Location.—Just below the dam at the outlet of Cross Lake, which is 15 miles above the mouth of Pine River, in the central part of Crow Wing County, in T. 137 N., R. 27 W.

Records available.—March, 1886, to December 31, 1911.

Drainage area.—452 square miles.

Area of reservoir surface above dam.—At low water 18 square miles; at high water 24 square miles. These areas, with a range of 16 and 15 feet, give a capacity of 7,732,900,000 cubic feet. The dam raises the water level in Cross, Pine, Daggett, Rush, Whitefish, Trout, and Hay lakes by varying amounts.

Discharge.—Determined from daily gage heights representing the head at the dam and from the various-sized openings in the dam.

Cooperation.—The station is maintained by the United States Engineer Corps for the purpose of measuring the flow from Pine River reservoir, the lowest in the present system of Government reservoirs on the headwaters of the Mississippi. Although the discharge of the dam represents the flow from the reservoir, it does not represent the entire flow of Pine River at its mouth because between the two points the drainage area of the river is increased from 452 to 691 square miles by Little Pine River and one or two other minor tributaries.

Daily discharge, in second-feet, of Pine River below Pine River reservoir, Minn., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	78	91	102	117	131	225	486	65	219	68	53	55
2	79	92	103	117	132	230	475	60	216	50	53	54
3	79	92	104	118	132	233	465	62	214	10	53	54
4	80	93	104	118	133	220	455	64	212	10	53	54
5	80	93	104	119	133	218	440	65	210	10	53	54
6	79	94	104	119	134	216	425	63	80	50	53	53
7	80	94	104	120	134	214	405	62	78	51	25	53
8	80	95	104	121	135	212	403	60	75	51	53	53
9	81	95	104	121	136	210	390	58	73	50	53	53
10	81	96	104	122	414	209	370	56	73	50	53	53
11	82	97	104	123	416	212	350	54	72	49	53	54
12	82	97	105	123	418	215	325	52	72	48	53	54
13	83	98	105	124	421	218	300	54	71	10	53	54
14	83	98	106	124	420	220	300	56	71	47	53	55
15	83	99	108	125	418	523	290	58	70	47	53	55
16	84	99	108	125	417	525	280	60	70	47	52	55
17	84	100	109	126	415	528	275	210	70	47	52	55
18	85	100	110	126	415	528	265	212	69	47	52	56
19	85	100	110	127	414	527	260	214	69	47	53	56
20	86	101	111	127	412	527	240	218	69	47	54	56
21	86	101	111	128	420	526	225	222	68	47	55	57
22	87	102	113	128	475	526	173	226	68	48	54	57
23	87	102	113	129	500	525	170	228	68	48	55	57
24	88	102	114	129	510	525	165	230	67	49	56	57
25	89	102	114	130	520	520	165	231	67	49	57	58
26	89	103	114	130	525	515	164	232	66	50	57	58
27	90	103	115	131	520	510	164	230	66	51	56	58
28	90	103	115	130	515	505	163	228	65	53	56	59
29	90	.....	116	131	510	495	163	226	50	53	55	59
30	91	.....	116	131	500	486	50	224	50	52	56	59
31	91	.....	115	.....	400	.....	50	222	.....	53	.....	59

NOTE.—Daily discharge compiled from unpublished records in the United States Engineer office at St. Paul.

Monthly discharge of Pine River below Pine River reservoir, Minn., for 1911.

[Drainage area, 452 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in millions of cubic feet.
January	91	78	84.3	0.187	0.22	226
February	103	91	97.9	.217	.23	237
March	116	102	109	.241	.28	292
April	131	117	125	.277	.31	324
May	525	131	360	.796	.92	964
June	528	209	378	.836	.93	980
July	486	50	286	.633	.73	766
August	232	52	138	.305	.35	370
September	219	50	92.9	.206	.23	241
October	68	10	44.8	.099	.11	120
November	57	25	52.9	.117	.13	137
December	59	53	55.6	.123	.14	149
The year	528	10	152	.336	4.58	4,810

NOTE.—Computed by engineers of the United States Geological Survey from unpublished records in the United States Engineer office at St. Paul.

CROW WING RIVER AT NIMROD, MINN.

Location.—At the steel highway bridge at Nimrod post office, in sec. 32, T. 137 N., R. 33 W.; about 12 miles east of Sebeka, the nearest railroad point, 1 mile above the mouth of Cat River, and 1 mile below the mouth of Willow Creek.

Records available.—April 15, 1910, to November 15, 1911.

Drainage area.—1,010 square miles.

Gage.—Chain gage, attached to the bridge. On May 19, 1910, the gage datum was lowered 1.20 feet and the readings prior to that date were corrected to the present datum.

Channel.—Probably permanent.

Discharge measurements.—Made from the bridge.

Regulation.—The river is used for log driving, and a dam at the outlet of Lower Crow Wing Lake controls the water from that portion of the drainage area. Since the establishment of the station there has been no trouble from log jams. Crow Wing River has considerable fall near the station and 1 mile above makes a descent of 12 feet, known as Westers Rapids.

Winter flow.—From November to March the river is frozen over and observations are discontinued.

Accuracy.—Discharge values below 160 and above 678 second-feet, published in the following tables, are based upon an extension of the discharge rating curve and should therefore be used with caution.

The following discharge measurement was made by S. B. Soulé:

July 11, 1911: Gage height, 4.54 feet; discharge, 186 second-feet.

Daily gage height, in feet, of Crow Wing River at Nimrod, Minn., for 1911.

[W. A. Wintermute, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	4.45	4.55	4.62	5.04	4.51	4.52	5.29	5.00
2	4.45	4.52	4.62	5.01	4.58	4.52	5.24	5.30
3	4.45	4.50	4.62	4.98	4.58	4.54	5.20	5.25
4	4.46	4.48	4.65	5.00	4.60	4.55	5.15	5.20
5	4.50	4.51	4.70	4.96	4.58	4.55	5.15	5.05
6	4.48	4.51	4.70	4.95	4.55	4.56	5.15	4.92
7	4.45	4.50	4.70	4.94	4.58	4.61	5.11	4.90
8	4.45	4.50	4.68	4.92	4.60	4.62	5.06	4.88
9	4.45	4.50	4.65	4.79	4.60	4.62	5.02	4.86
10	4.48	4.50	4.65	4.76	4.60	4.62	5.00	4.85
11	4.54	4.50	4.65	4.70	4.60	4.61	4.98	4.85
12	4.59	4.50	4.65	4.49	4.59	4.60	5.00	.....
13	4.66	4.50	4.69	4.44	4.58	4.62	5.00	.....
14	4.68	4.50	[a] 5.25	4.40	4.58	4.65	5.00	.....
15	4.70	4.51	5.60	4.40	4.56	4.65	5.00	.....
16	4.70	4.51	5.60	4.40	4.55	4.65	5.00	.....
17	4.70	4.62	5.52	4.40	4.55	4.62	4.98	.....
18	4.70	4.62	5.44	4.40	4.55	4.62	4.98	.....
19	4.71	4.60	5.40	4.38	4.55	4.62	4.95	.....
20	4.71	4.60	5.36	4.36	4.55	4.65	4.92	.....
21	4.70	4.60	5.31	4.31	4.55	[a] 5.65	4.92	.....
22	4.68	4.58	5.34	4.30	4.58	5.80	4.92	.....
23	4.64	4.58	5.45	4.40	4.58	5.76	4.92	.....
24	4.59	4.55	5.49	4.49	4.58	5.68	4.90	.....
25	4.58	4.55	5.42	4.50	4.58	5.59	4.90	.....
26	4.58	4.55	5.36	4.49	4.55	5.54	4.90	.....
27	4.58	4.55	5.29	4.48	4.55	5.46	4.88	.....
28	4.58	4.55	5.24	4.48	4.54	5.38	4.88	.....
29	4.58	4.59	5.19	4.48	4.52	5.35	4.88	.....
30	4.58	4.62	5.09	4.48	4.52	5.32	4.85	.....
31	.....	4.62	.....	4.48	4.52	.....	4.85	.....

[a] Rise caused by opening of logging dam above gaging station.

NOTE.—Ice present to Jan. 1 to Mar. 31 and Nov. 12 to Dec. 31.

Daily discharge, in second-feet, of Crow Wing River at Nimrod, Minn., for 1910–1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1910.								
1	.....	486	923	184	160	140	758	276
2	.....	472	923	184	160	140	758	276
3	.....	515	1,140	184	160	140	758	276
4	.....	530	880	184	160	140	758	270
5	.....	530	494	208	160	152	694	264
6	.....	530	356	208	160	144	619	264
7	.....	515	324	208	160	140	567	.....
8	.....	494	312	253	160	140	530	.....
9	.....	486	270	253	160	140	523	.....
10	.....	472	264	236	160	140	486	.....
11	.....	464	264	264	160	140	429	.....
12	.....	457	264	236	179	140	402	.....
13	.....	457	264	208	198	375	395	.....
14	.....	457	253	208	198	718	388	.....
15	530	457	219	203	184	822	362	.....
16	567	486	208	203	165	798	330	.....
17	619	537	208	160	152	457	300	.....
18	686	545	208	160	140	160	276	.....
19	742	523	208	160	140	140	312	.....
20	758	530	203	160	136	140	324	.....
21	710	574	189	160	128	128	356	.....
22	678	597	179	160	144	103	375	.....
23	678	589	165	170	140	120	375	.....
24	678	742	160	184	128	120	362	.....
25	678	906	179	184	128	422	356	.....
26	648	1,060	170	184	128	758	350	.....
27	611	1,140	184	179	128	774	337	.....
28	574	1,170	184	170	128	774	324	.....
29	523	1,280	184	170	128	774	318	.....
30	501	993	184	160	128	758	300	.....
31	.....	923	.....	160	128	.....	294	.....
1911.								
1	140	184	219	486	165	170	671	457
2	140	170	219	464	198	170	634	678
3	140	160	219	443	198	179	604	641
4	144	152	236	457	208	184	567	604
5	160	165	264	429	198	184	567	494
6	152	165	264	422	184	189	567	402
7	140	160	264	416	198	214	537	388
8	140	160	253	402	208	219	501	375
9	140	160	236	318	208	219	472	362
10	152	160	236	300	208	219	457	356
11	179	160	236	264	208	214	443	356
12	203	160	236	156	203	208	457	.....
13	242	160	258	136	198	219	457	.....
14	253	160	641	120	198	236	457	.....
15	264	165	923	120	189	236	457	.....
16	264	165	923	120	184	236	457	.....
17	264	219	855	120	184	219	443	.....
18	264	219	790	120	184	219	443	.....
19	270	208	758	113	184	219	422	.....
20	270	208	726	106	184	236	402	.....
21	264	208	686	89	184	966	402	.....
22	253	198	710	86	198	1,100	402	.....
23	230	198	798	120	198	1,060	402	.....
24	203	184	830	156	198	993	388	.....
25	198	184	774	160	198	914	388	.....
26	198	184	726	156	184	872	388	.....
27	198	184	671	152	184	806	375	.....
28	198	184	634	152	179	742	375	.....
29	198	203	597	152	170	718	375	.....
30	198	219	523	152	170	694	356	.....
31	.....	219	.....	152	170	.....	356	.....

NOTE.—Daily discharge computed from a rating curve fairly well defined between discharges 160 and 678 second-feet (gage heights 4.5 and 5.3 feet).

Monthly discharge of Crow Wing River at Nimrod, Minn., for 1910–1911.

[Drainage area, 1,010 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1910.						
April 15–30	758	501	636	0.630	0.37	A.
May	1,280	457	642	.636	.73	A.
June	1,140	160	332	.329	.37	A.
July	264	160	192	.190	.22	A.
August	198	128	151	.150	.17	B.
September	822	103	335	.332	.37	B.
October	758	276	442	.438	.50	B.
November 1–6	276	264	271	.268	.06	B.
1911.						
April	270	140	202	.200	.22	B.
May	219	152	181	.179	.21	B.
June	923	219	524	.519	.58	B.
July	486	86	227	.225	.26	A.
August	208	165	191	.189	.22	A.
September	1,100	170	435	.431	.48	B.
October	671	356	459	.454	.52	A.
November 1–11	678	356	465	.460	.19	B.

CROW WING RIVER AT PILLAGER, MINN.

Location.—At highway bridge, half a mile south of Pillager, in sec. 20, T. 133 N., R. 30 W., a short distance above the mouth of Pillager Creek.

Records available.—May 25 to September 1, 1903, June 11, 1909, to December 31, 1911.

Drainage area.—3,230 square miles.

Gage.—Vertical staff; datum unchanged since established.

Channel.—Probably permanent except during high water.

Discharge measurements.—Made from the bridge.

Regulation.—No dams near the station, as the only one on the river is a logging dam at the outlet of Lower Crow Wing Lake.

Winter flow.—The river is frozen over at the gage from December to March, and during that period measurements are made through the ice to determine the winter discharge.

Accuracy.—Conditions at this station are favorable for fairly good results, although the shifting of the river bed during high water may necessitate the use of more than one rating curve.

Discharge measurements of Crow Wing River at Pillager, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Apr. 6	C. R. Adams	5.37	542
Dec. 15[a]	S. B. Soulé	6.22	476

[a] Measurement made under ice cover. Average thickness of ice, 0.80 foot. Average distance water surface to top of ice, 0.05 foot.

Daily gage height, in feet, of Crow Wing River at Pillager, Minn., for 1911.

[Miss Eureka Holmgren, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.55	5.52	5.50	5.63	5.17	4.90	5.92	5.22	.....
2	.....	5.50	5.52	5.50	5.52	5.10	4.90	5.92	5.22	6.13
3	.....	5.50	5.46	5.68	5.42	5.15	4.90	5.95	5.55	.....
4	.....	5.50	5.40	5.80	5.50	5.22	4.92	5.92	5.54	.....
5	.....	5.40	5.40	5.80	5.51	5.32	4.98	5.85	5.70	.....
6	.....	5.45	5.40	5.78	5.48	5.30	5.03	5.84	5.72	6.12
7	.....	5.45	5.38	5.72	5.38	5.30	5.12	5.82	5.78	.....
8	.....	5.42	5.35	5.62	5.30	5.25	5.20	5.80	5.80	.....
9	.....	5.42	5.35	5.52	5.28	5.22	5.23	5.80	5.82	6.15
10	.....	5.40	5.38	5.52	5.15	5.20	5.20	5.80	5.70	.....
11	6.7	5.55	5.40	5.48	5.05	5.20	5.18	5.72	5.20	.....
12	.....	5.70	5.40	5.38	4.92	5.20	5.16	5.70	.....	.....
13	.....	5.85	5.39	5.32	4.82	5.18	5.24	5.85	.....	6.15
14	.....	5.92	5.40	5.30	4.72	5.10	5.22	5.82	.....	.....
15	6.72	5.98	5.50	5.72	4.72	5.30	5.24	5.90	.....	6.22
16	.....	5.88	5.68	6.02	4.69	5.15	5.28	5.98	.....	6.25
17	.....	5.82	5.90	6.11	4.66	5.10	5.10	6.00	.....	.....
18	.....	5.78	5.82	6.08	4.70	5.10	5.18	6.02	.....	.....
19	.....	5.80	5.78	5.92	4.70	5.00	5.27	6.00	.....	.....
20	.....	5.78	5.72	5.90	4.70	5.00	5.30	5.95	.....	6.30
21	.....	5.72	5.60	5.80	4.70	5.00	5.30	5.88	.....	.....
22	6.30	5.70	5.55	5.70	4.72	5.00	6.10	5.87	.....	.....
23	6.10	5.65	5.50	5.71	4.85	5.00	6.20	5.88	.....	6.35
24	6.15	5.62	5.48	5.78	5.05	5.00	6.20	5.90	.....	.....
25	5.95	5.52	5.50	5.70	5.10	4.98	6.18	5.90	.....	.....
26	5.80	5.55	5.38	5.78	5.05	4.90	6.05	5.80	.....	.....
27	5.45	5.52	5.29	5.70	5.05	4.92	6.00	5.75	.....	6.30
28	5.65	5.50	5.26	5.70	5.00	4.95	6.00	5.70	.....	.....
29	5.80	5.52	5.20	5.70	4.95	4.94	6.00	5.70	6.15	6.30
30	5.60	5.52	5.30	5.70	4.90	5.00	6.00	5.70	.....	.....
31	5.60	.....	5.27	.....	4.92	4.98	.....	5.35	.....	.....

NOTE.—Ice present Jan. 1 to Mar. 25 and Nov. 12 to Dec. 31.

Daily discharge, in second-feet, of Crow Wing River at Pillager, Minn., for 1911.

Date.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	644	627	615	691	443	328	877	467
2	.....	615	627	615	627	410	328	877	467
3	.....	615	593	722	571	434	328	897	644
4	.....	615	560	797	615	467	336	877	638
5	.....	560	560	797	621	518	359	830	734
6	.....	588	560	784	604	507	380	823	747
7	.....	588	549	747	549	507	419	810	784
8	.....	571	534	685	507	482	457	797	797
9	.....	571	534	627	497	467	472	797	810
10	.....	560	549	627	434	457	457	797	734
11	.....	644	560	604	388	457	448	747	457
12	.....	734	560	549	336	457	438	734	.....
13	.....	830	555	518	299	448	477	830	.....
14	.....	877	560	507	266	410	467	810	.....
15	.....	917	615	747	266	507	477	863	.....
16	.....	850	722	945	257	434	497	917	.....
17	.....	810	863	1,010	249	410	410	931	.....
18	.....	784	810	987	260	410	448	945	.....
19	.....	797	784	877	260	367	492	931	.....
20	.....	784	747	863	260	367	507	897	.....
21	.....	747	673	797	260	367	507	850	.....
22	.....	734	644	734	266	367	1,000	843	.....
23	.....	704	615	740	310	367	1,070	850	.....
24	.....	685	604	784	388	367	1,070	863	.....
25	.....	627	615	734	410	359	1,060	863	.....

Daily discharge, in second-feet, of Crow Wing River at Pillager, Minn., for 1911—Contd.

Date.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
26	797	644	549	784	388	328	966	797	.....
27	588	627	502	734	388	336	931	766	.....
28	704	615	487	734	367	348	931	734	.....
29	797	627	457	734	348	344	931	734	.....
30	673	627	507	734	328	367	931	734	.....
31	673	.....	492	.....	336	359	.....	534	.....

NOTE.—Discharge Jan. 1 to Mar. 25 and Nov. 12 to Dec. 31 estimated, because of ice, from one discharge measurement, climatologic records, observer's notes, and discharge of adjacent drainage areas. Mean discharge Jan. 1 to 31 estimated 370 second-feet. Mean discharge Feb. 1 to 28 estimated 360 second-feet. Mean discharge Mar. 1 to 25 estimated 500 second-feet, varying from about 400 to 750 second-feet. Mean discharge Nov. 12 to 30 estimated 435 second-feet, varying from about 430 to 450 second-feet. Mean discharge Dec. 1 to 31 estimated 450 second-feet, varying from about 420 to 480 second-feet.

Monthly discharge of Crow Wing River at Pillager, Minn., for 1911.

[Drainage area, 3,230 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	370	0.115	0.13	D.
February	.....	.....	360	.111	.12	D.
March	.....	.....	540	.167	.19	D.
April	917	560	686	.212	.24	B.
May	863	457	600	.186	.21	B.
June	1,010	507	738	.228	.25	B.
July	691	249	398	.123	.14	C.
August	518	328	415	.128	.15	C.
September	1,070	328	597	.185	.21	B.
October	945	534	824	.255	.29	B.
November	810	.....	518	.160	.18	C.
December	.....	.....	450	.139	.16	C.
The year	1,070	249	539	.167	2.27	

NOTE.—See footnotes to table of daily discharge.

LONG PRAIRIE RIVER NEAR MOTLEY, MINN.

Location.—100 yards above the highway bridge 1 mile south of Motley, in sec. 19, T. 133 N., R. 31 W., and 2 miles above the mouth of the river.

Records available.—June 10, 1909, to December 31, 1911.

Drainage area.—973 square miles.

Gage.—Vertical staff; datum unchanged since established.

Channel.—Fairly permanent.

Discharge measurements.—During all stages except low, discharge measurements are made from the bridge, but low-water measurements are made by wading at a short distance upstream.

Winter flow.—From November to March the river is frozen over at the gage, and observations are discontinued.

Accuracy.—There are no dams on the river to affect its flow at the gaging station. Backwater caused by ice gorges in Crow Wing River may possibly affect gage heights for a few days in the spring.

The following discharge measurement was made by C. R. Adams:

April 7, 1911: Gage height, 4.98 feet; discharge, 94.4 second-feet.

Daily gage height, in feet, of Long Prairie River near Motley, Minn., for 1911.

[John Greene, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	5.11	5.09	5.15	4.82	4.85	4.84	5.62	5.25
2	.....	5.09	5.09	5.16	4.76	4.82	4.84	5.62	5.19
3	.....	5.08	5.06	5.20	4.74	4.92	4.82	5.75	5.62
4	.....	5.06	5.02	5.29	4.74	4.94	4.84	5.62	5.38
5	.....	4.97	5.04	5.30	4.81	4.92	4.82	5.42	5.38
6	.....	5.06	5.04	5.24	4.88	4.94	4.85	5.14	5.42
7	.....	4.98	5.02	5.16	4.86	4.91	4.90	5.14	5.12
8	.....	5.08	5.02	5.11	4.84	4.89	4.91	5.15	5.15
9	.....	5.09	5.02	5.05	4.79	4.90	4.92	5.14	5.12
10	.....	5.11	5.02	5.04	4.76	4.91	4.92	5.12	5.00
11	.....	5.12	5.00	5.01	4.74	4.89	4.90	5.11	5.30
12	.....	5.15	4.99	4.98	4.72	4.89	4.90	5.11	.....
13	.....	5.25	5.01	4.95	4.70	4.88	4.88	5.11	.....
14	.....	5.28	5.05	4.95	4.69	4.89	5.02	5.16	.....
15	.....	5.24	5.04	4.92	4.68	4.86	5.15	5.20	.....
16	.....	5.24	5.28	4.90	4.66	4.86	5.24	5.22	.....
17	.....	5.21	5.32	4.89	4.66	4.84	5.26	5.30	.....
18	.....	5.19	5.26	4.89	4.68	4.85	5.24	5.34	.....
19	.....	5.18	5.29	4.85	4.66	4.84	5.21	5.35	.....
20	.....	5.15	5.25	4.84	4.68	4.84	5.22	5.32	.....
21	.....	5.15	5.18	4.80	4.70	4.84	5.26	5.34	.....
22	.....	5.15	5.12	4.76	4.71	4.81	5.28	5.36	.....
23	.....	5.14	5.10	4.75	4.78	4.80	5.26	5.34	.....
24	.....	5.11	5.10	4.72	4.75	4.80	5.19	5.31	.....
25	.....	5.10	5.08	4.72	4.74	4.81	5.14	5.28	.....
26	5.20	5.10	5.08	4.72	4.72	4.80	5.10	5.28	.....
27	5.18	5.09	5.06	4.72	4.72	4.80	5.08	5.25	.....
28	5.12	5.10	5.05	4.72	4.75	4.79	5.09	5.20	.....
29	5.16	5.08	5.05	4.78	4.74	4.80	5.06	5.16	.....
30	5.14	5.08	5.11	4.78	4.71	4.82	5.08	5.15	.....
31	5.10	.....	5.14	.....	4.81	4.84	.....	5.62	.....

NOTE.—Ice present Jan. 1 to Mar. 25 and Nov. 11 to Dec. 31.

Daily discharge, in second-feet, of Long Prairie River near Motley, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	125	120	135	67	72	70	301	163
2	.....	120	120	138	59	67	70	301	145
3	.....	117	113	148	56	84	67	361	301
4	.....	113	104	175	56	88	70	301	205
5	.....	93	108	178	66	84	67	220	205
6	.....	113	108	160	77	88	72	132	220
7	.....	95	104	138	74	82	80	132	127
8	.....	117	104	125	70	78	82	135	135
9	.....	120	104	110	63	80	84	132	127
10	.....	125	104	108	59	82	84	127	99
11	.....	127	99	101	56	78	80	125	[a] 178
12	.....	135	97	95	54	78	80	125	.....
13	.....	163	101	90	51	77	77	125	.....
14	.....	172	110	90	50	78	104	138	.....
15	.....	160	108	84	49	74	135	148	.....
16	.....	160	172	80	47	74	160	154	.....
17	.....	151	185	78	47	70	166	178	.....
18	.....	145	166	78	49	72	160	192	.....
19	.....	143	175	72	47	70	151	195	.....
20	.....	135	163	70	49	70	154	185	.....
21	.....	135	143	64	51	70	166	192	.....
22	.....	135	127	59	52	66	172	198	.....
23	.....	132	122	58	61	64	166	192	.....
24	.....	125	122	54	58	64	145	181	.....
25	.....	122	117	54	56	66	132	172	.....
26	148	122	117	54	54	64	122	172	.....
27	143	120	113	54	54	64	117	163	.....
28	127	122	110	54	58	63	120	148	.....
29	138	117	110	61	56	64	113	138	.....
30	132	117	125	61	52	67	117	135	.....
31	122	.....	132	.....	66	70	.....	301	.....

[a] Probably too high.

NOTE.—Daily discharge computed from a well-defined rating curve.

Monthly discharge of Long Prairie River near Motley, Minn., for 1911.

[Drainage area, 973 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
March 26-31	148	122	135	0.139	0.03	B.
April	172	93	129	.133	.15	A.
May	185	97	123	.126	.15	A.
June	178	54	94.2	.097	.11	A.
July	77	47	56.9	.058	.07	B.
August	88	63	73.2	.075	.09	A.
September	172	67	113	.116	.13	A.
October	361	125	184	.189	.22	A.
November 1-11	301	99	173	.178	.07	B.

SAUK RIVER NEAR ST. CLOUD, MINN.

Location.—At highway bridge, 3 miles west of St. Cloud, in sec. 9, T. 124 N., R. 28 W., 10 miles below the nearest tributary, which enters at Rockville.

Records available.—July 8, 1909, to December 31, 1911.

Drainage area.—816 square miles.

Gage.—Chain; attached to bridge; datum unchanged since established. The gage is read twice a day, and the mean of the readings is recorded as the mean for the day.

Channel.—Shifting during high water.

Discharge measurements.—Made from the bridge.

Regulation.—At the mouth of the river there is a dam 9 feet high. The station is above the influence of the dam, and backwater from the Mississippi does not reach the station. The first dam above the station is at Cold Spring, 15 miles distant. The opening and shutting of the turbine gates at this dam affect the flow at the gaging station during the low-water season.

Winter flow.—From December to March the river is frozen completely over in the vicinity of the gaging station, and measurements are made through the ice to determine the winter discharge.

Accuracy.—The mean daily gage height during the low-water season is subject to some error resulting from daily fluctuations in the stage of the river caused by control of flow by dams above the station, and therefore the records for that period can not be considered better than fair.

Discharge measurements of Sauk River near St. Cloud, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Apr. 8	C. R. Adams	5.80	98.0
Oct. 25	S. B. Soulé	5.66	76.2
Nov. 29[a]	W. G. Hoyt	6.88	135
Dec. 29[b]	S. B. Soulé	6.53	116

[a] Complete ice cover. Average thickness of ice, 0.82 foot. Average distance water surface to top ice, —0.03 foot.

[b] Complete ice cover. Average thickness of ice, 0.87 foot. Average distance water surface to surface ice, 0.00 foot. Gage height to top of ice, 6.18 feet. Thickness of ice at gage, 1.68 feet.

Daily gage height, in feet, of Sauk River near St. Cloud, Minn., for 1911.

[Miss Ida Waite, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	6.55	5.50	5.20	5.70	5.75	5.66	5.88	5.30	6.1
2	6.5	.....	.....	6.55	5.55	5.35	5.65	5.66	5.78	5.72	5.35	.....
3	.....	.....	.....	6.45	5.55	5.50	5.50	5.70	5.92	5.90	5.55	.....
4	.....	6.8	.....	5.65	5.55	5.50	5.40	5.70	5.86	5.80	5.65	6.70
5	.....	.....	.....	5.60	5.55	5.28	5.70	5.78	5.82	5.75	5.25	.....
6	6.7	.....	.....	5.50	5.55	5.35	5.55	5.90	5.90	5.80	5.60	.....
7	.....	6.9	.....	5.50	5.55	5.45	5.46	6.00	5.95	5.66	5.70	6.30
8	.....	.....	.....	5.70	5.45	5.50	5.62	5.90	6.00	5.81	5.75	.....
9	.....	.....	.....	5.30	5.25	5.50	5.65	5.81	5.38	6.00	5.85	.....
10	6.7	.....	.....	5.55	5.45	5.50	5.60	5.71	5.50	5.94	6.20	.....
11	.....	6.8	.....	5.25	5.55	5.39	5.42	5.83	5.85	5.85	5.95	6.1
12	.....	.....	.....	5.55	5.75	5.48	5.55	5.70	5.70	5.88	.....	.....
13	.....	.....	.....	5.35	5.55	5.55	5.60	5.95	5.85	5.86	.....	.....
14	.....	.....	.....	5.55	5.95	5.40	5.70	5.85	5.95	5.88	.....	.....
15	6.7	.....	.....	5.25	5.60	5.40	5.60	5.71	5.78	5.82	.....	6.6
16	.....	.....	.....	5.50	5.60	5.54	5.85	5.88	5.88	5.72	.....	.....
17	.....	.....	.....	5.25	5.40	5.50	5.51	6.02	5.55	5.65	.....	.....
18	.....	.....	.....	5.30	5.40	5.75	5.52	5.88	5.60	5.80	.....	6.2
19	6.6	.....	6.55	5.50	5.50	5.60	5.35	5.50	5.75	5.60	.....	.....
20	.....	.....	6.6	5.55	5.55	5.48	5.59	5.55	5.85	5.95	6.0	.....
21	.....	.....	6.3	5.50	5.55	5.52	5.74	5.30	5.75	5.90	.....	.....
22	6.7	.....	6.25	5.45	5.45	5.38	5.75	5.45	5.85	5.70	.....	.....
23	.....	.....	6.5	5.50	5.70	5.16	5.78	5.55	5.95	5.68	6.2	6.1
24	.....	.....	6.55	5.25	5.55	5.40	5.85	5.50	5.99	5.80	.....	.....
25	.....	.....	6.75	5.20	5.50	5.50	5.58	5.35	5.95	5.70	.....	.....
26	6.5	.....	5.55	5.15	5.55	5.40	5.75	5.85	5.82	5.65	.....	6.1
27	.....	.....	5.55	5.55	5.60	5.65	5.68	5.60	5.85	5.55	6.20	.....
28	.....	.....	5.55	5.55	5.45	5.60	5.88	5.45	5.68	5.50	.....	.....
29	.....	.....	5.7	5.50	5.55	5.85	5.85	5.55	5.88	5.60	6.88	6.53
30	6.6	.....	5.75	5.60	5.60	5.75	5.75	5.50	5.95	5.50	.....	.....
31	.....	.....	6.7	.....	5.95	.....	5.25	5.90	.....	5.25	.....	.....

NOTE.—Ice present Jan. 1 to Mar. 18 and from Oct. 27 to Dec. 31; average thickness from Oct. 27 to Dec. 31, about 2 feet; average thickness beginning Nov. 12, about 1 foot.

Daily discharge, in second-feet, of Sauk River near St. Cloud, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	300	56	30	82	90	76	116	37
2	.....	300	62	42	75	76	96	85	42
3	.....	266	62	56	56	82	124	120	62
4	.....	75	62	56	46	82	112	99	75
5	.....	68	62	36	82	96	103	90	34
6	.....	56	62	42	62	120	120	99	68
7	.....	56	62	51	52	142	131	76	82
8	.....	82	51	56	71	120	142	101	90
9	.....	37	34	56	75	101	44	142	110
10	.....	62	51	56	68	84	56	129	[a] 192
11	.....	34	62	45	48	105	110	110	131
12	.....	62	90	54	62	82	82	116	.....
13	.....	42	62	62	68	131	110	112	.....
14	.....	62	131	46	82	110	131	116	.....
15	.....	34	68	46	68	84	96	103	.....
16	.....	56	68	61	110	116	116	85	.....
17	.....	34	46	56	57	147	62	75	.....
18	.....	37	46	90	58	116	68	99	.....
19	300	56	56	68	42	56	90	68	.....
20	317	62	62	54	67	62	110	131	.....
21	220	56	62	58	89	37	90	120	.....
22	206	51	51	44	90	51	110	82	.....
23	282	56	82	28	96	62	131	79	.....
24	300	34	62	46	110	56	140	99	.....
25	378	30	56	56	66	42	131	82	.....

[a] Discharge may be too high as result of applying open channel rating table—that is, relation of gage height to discharge may have been affected by ice.

Daily discharge, in second-feet, of Sauk River near St. Cloud, Minn., for 1911—Contd.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
26	62	27	62	46	90	110	103	75	.....
27	62	62	68	75	79	68	110	62	.....
28	62	62	51	68	116	51	79	56	.....
29	82	56	62	110	110	62	116	68	.....
30	90	68	68	90	90	56	131	56	.....
31	356	.....	131	.....	75	120	.....	34	.....

NOTE.—Daily discharge computed from a well-defined rating curve. Discharge Mar. 1 to 18 and Nov. 12 to Dec. 31 estimated, because of ice, from discharge measurements, gage observer's notes, and climatologic records. Mean discharge Mar. 1 to 18 estimated 50 second-feet, varying from about 15 to 200 second-feet. Mean discharge Nov. 12 to 30 estimated 120 second-feet, varying from about 110 to 135 second-feet. Mean discharge Dec. 1 to 31 estimated 135 second-feet, varying from about 110 to 150 second-feet.

Monthly discharge of Sauk River near St. Cloud, Minn., for 1911.

[Drainage area, 816 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	[a] 12.0	0.015	0.02	C.
February	.....	.....	[a] 10.0	.012	.01	D.
March	378	.....	117	.143	.16	B.
April	300	27	76.1	.093	.10	A.
May	131	34	64.8	.079	.09	A.
June	110	28	56.1	.069	.08	A.
July	116	42	75.5	.093	.11	A.
August	147	37	87.6	.107	.12	A.
September	142	44	104	.127	.14	A.
October	142	34	93.1	.114	.13	A.
November	.....	.....	107	.131	.15	C.
December	.....	.....	135	.164	.19	C.
The year	378	.....	78.6	.096	1.30	

[a] Estimated from one discharge measurement, semiweekly gage heights, and climatologic records.
NOTE.—See footnotes to table of daily discharge.

ELK RIVER NEAR BIG LAKE, MINN.

Location.—At the highway bridge 4 miles east of Big Lake and half a mile east of Bailey station on the Northern Pacific Railway; in sec. 23, T. 33 N., R. 27 W., one-half mile above Tibbetts Brook and 4 miles below mouth of St. Francis River.

Records available.—Gage heights and discharge measurements from April 15, 1911, to December 31, 1911.

Drainage area.—615 square miles.

Gage.—Vertical staff.

Channel.—Probably permanent, as small rapids a short distance below are the control point.

Discharge measurements.—Made from the highway bridge at all stages except low, when wading measurements are made nearby.

Regulation.—The flow of the river above the station is entirely uncontrolled, as the only dam on the river is near the mouth, about 8 miles below.

Winter flow.—From December to March the relation between gage heights and discharge is affected by ice, and during that period measurements are made to determine the winter discharge.

Discharge measurements of Elk River near Big Lake, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 10	C. J. Emerson	0.38	72.5
July 16	S. B. Soulé [a]	.22	43.4
Oct. 26	do	.90	205
Nov. 28 [b]	Hoyt and Soulé	.98	95.6
Dec. 28 [c]	S. B. Soulé	1.08	106

[a] Wading measurement.
[b] Complete ice cover. Average thickness of ice, 0.36 foot; average distance water surface to top of ice, 0.00 foot.
[c] 90 per cent ice cover. Average thickness of ice at measuring section, 0.55 foot.

Daily gage height, in feet, of Elk River near Big Lake, Minn., for 1911.

[Michael E. Tracy, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		0.48	0.51	0.40	0.50	0.38	0.51	0.71	
2		.45	.51	.36	.45	.35	.46	.66	
3		.45	.55	.34	.41	.34	.60	.65	
4		.44	.66	.31	.46	.39	.64	.68	0.98
5		.40	.61	.45	.44	.42	.61	.68	
6		.38	.59	.42	.42	.44	.84	.74	
7		.38	.65	.38	.48	.45	.86	.69	.98
8		.38	.78	.34	.49	.45	.79	.66	
9		.38	.75	.32	.45	.44	.78	.64	
10		.38	.66	.31	.44	.41	.76	.61	
11		.34	.62	.29	.41	.50	.75	.56	1.12
12		.32	.61	.26	.40	.50	.72	.55	
13		.35	.58	.25	.39	.46	.72	.72	
14	0.70	.40	.54	.24	.39	.48	.88		1.02
15	.65	.69	.49	.22	.38	.46	.89		
16	.64	.76	.55	.22	.38	.44	.94	.85	
17	.61	.72	.60	.22	.38	.42	1.02		
18	.59	.70	.52	.24	.34	.44	1.05		.98
19	.62	.95	.49	.28	.32	.42	1.05		
20	.65	1.00	.44	.28	.31	.41	1.05	.90	
21	.60	.98	.39	.26	.31	.42	1.04		1.05
22	.58	1.10	.38	.24	.34	.41	.99		
23	.55	1.11	.36	.25	.35	.40	.98	.92	
24	.52	1.01	.34	.25	.32	.40	.96		
25	.52	.90	.34	.25	.31	.38	.94		1.12
26	.49	.82	.54	.24	.31	.38	.89		
27	.48	.74	.45	.22	.39	.40	.86	.98	
28	.48	.69	.40	.29	.36	.41	.84	.98	1.09
29	.48	.64	.48	.28	.35	.56	.81		
30	.48	.58	.49	.26	.38	.52	.79	.98	
31		.55		.28	.38		.76		

NOTE.—Relation of gage height to discharge affected by ice about Nov. 13 to Dec. 31.

Daily discharge, in second-feet, of Elk River near Big Lake, Minn., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		96	102	80	100	76	102	146
2		90	102	72	90	70	92	135
3		90	110	69	82	69	121	132
4		88	135	63	92	78	130	139
5		80	123	90	88	84	123	139
6		76	119	84	84	88	178	154
7		76	132	76	96	90	184	142
8		76	163	69	98	90	166	135
9		76	156	65	90	88	163	130
10		76	135	63	88	82	158	123

Daily discharge, in second-feet, of Elk River near Big Lake, Minn., for 1911—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
11	.....	69	126	59	82	100	156	113
12	.....	65	123	54	80	100	149	110
13	.....	70	117	52	78	92	149	.....
14	144	80	108	50	78	96	189	.....
15	132	142	98	47	76	92	191	.....
16	130	158	110	47	76	88	205	.....
17	123	149	121	47	76	84	228	.....
18	119	144	104	50	69	88	236	.....
19	126	208	98	57	65	84	236	.....
20	132	222	88	57	63	82	236	.....
21	121	216	78	54	63	84	233	.....
22	117	250	76	50	69	82	219	.....
23	110	253	72	52	70	80	216	.....
24	104	225	69	52	65	80	211	.....
25	104	194	69	52	63	76	205	.....
26	98	173	108	50	63	76	191	.....
27	96	154	90	47	78	80	184	.....
28	96	142	80	59	72	82	178	.....
29	96	130	96	57	70	113	174	.....
30	96	117	98	54	76	104	166	.....
31	.....	110	.....	57	76	.....	158	.....

NOTE.—Daily discharge computed from a rating curve well defined and which was determined from discharge measurements made during 1912, before the publication of this report, in addition to 1911 discharge measurements. Discharge Nov. 13 to Dec. 31 estimated, because of ice, from discharge measurements, observer's notes, climatologic records, and discharge of adjacent drainage areas. Mean discharge Nov. 13 to 30, estimated 100 second-feet. Mean discharge Dec. 1 to 31, estimated 110 second-feet.

Monthly discharge of Elk River near Big Lake, Minn., for 1911.

[Drainage area, 615 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
April 14-30	144	96	114	0.185	0.12	A.
May	253	65	132	.215	.25	A.
June	163	69	107	.174	.19	A.
July	90	47	59.2	.096	.11	B.
August	100	63	77.9	.127	.15	B.
September	113	69	85.9	.140	.16	B.
October	236	92	178	.289	.33	A.
November	154	.....	113	.184	.21	C.
December	.....	.....	110	.179	.21	C.

NOTE.—See footnotes to tables of daily gage height and daily discharge.

CROW RIVER AT ROCKFORD, MINN.

Location.—At the highway bridge at Rockford, a little more than a mile below the junction of the North and South branches. Between the junction and the station are the outlets of Rebecca Lake and Lake Sarah, both very small streams.

Records available.—June 4, 1909, to December 31, 1911.

Drainage area.—2,520 square miles.

Gage.—Vertical staff; datum unchanged since established.

Channel.—Probably permanent.

Discharge measurements.—During high and medium stages discharge measurements are made from the bridge, but during low stages measurements are made from a boat and cable several hundred yards downstream.

Regulation.—A short distance above the station is the 7-foot dam of a flour mill which operates intermittently. As the turbine uses but a small portion of the flow, the effect of shutting it down is inappreciable at the gage except during extreme low water. At that time four readings per day are taken to determine the mean flow. This dam was partly destroyed May 31, 1911, and has not yet been rebuilt.

Winter flow.—Gage heights are little affected by ice. The dam is so near the station that the stream remains open for the greater part of the section and for a distance of several hundred yards below. Winter measurements show that the open channel rating curve applies throughout the year.

Accuracy.—Conditions at this station are favorable for excellent results, and therefore the records should be reliable. Stations were originally established on both branches above their junction to be used as a check on the Rockford records, but the conditions on the North Branch were so unsatisfactory that its station was discontinued June 30, 1910.

Discharge measurements of Crow River at Rockford, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 15[a]	S. B. Soulé	5.01	142
Dec. 22[b]	.....do	4.96	138

[a] Measurements made by wading. [b] Measurement at regular section, 26 per cent ice cover.

Daily gage height, in feet, of Crow River at Rockford, Minn., for 1911.

[Geo. W. Florida, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.72	4.58	4.64	5.02	4.95	5.22	5.10	4.80	4.80	4.87	5.18	5.00
2	4.70	4.58	4.64	4.96	4.96	5.14	5.02	4.82	4.78	4.86	4.98	5.00
3	4.67	4.58	4.63	5.01	4.94	5.16	4.97	4.85	4.78	4.96	5.06	5.00
4	4.66	4.60	4.64	5.02	4.92	5.16	4.91	4.83	4.80	5.05	5.12	5.00
5	4.68	4.55	4.57	5.02	4.92	5.80	4.90	4.82	4.82	5.62	5.14	4.99
6	4.68	4.58	4.65	5.02	4.89	5.64	4.94	4.82	4.82	6.10	5.15	5.00
7	4.64	4.57	4.66	5.02	4.88	5.62	4.93	4.82	4.82	6.46	5.15	4.98
8	4.65	4.58	4.68	5.03	4.90	5.60	4.92	4.84	4.82	6.50	5.14	5.00
9	4.64	4.56	4.72	5.01	4.88	5.48	4.94	4.88	4.82	6.15	5.18	5.00
10	4.64	4.58	4.74	5.03	4.86	5.32	4.96	4.85	4.80	5.75	5.10	5.04
11	4.64	4.58	4.81	5.13	4.88	5.28	4.95	4.81	4.92	5.60	4.94	5.02
12	4.64	4.56	4.87	5.16	4.88	5.19	4.94	4.78	4.96	5.58	4.90	5.02
13	4.64	4.58	4.92	5.20	4.86	5.22	4.92	4.84	5.05	5.54	5.06	5.04
14	4.63	4.58	4.95	5.16	4.85	5.04	4.90	4.85	5.04	5.54	5.04	5.04
15	4.60	4.59	4.96	5.18	4.96	5.03	4.86	4.85	5.00	5.54	5.06	5.06
16	4.62	4.60	5.02	5.18	5.03	5.14	4.84	4.95	4.94	5.58	5.05	5.10
17	4.62	4.60	5.04	5.17	5.12	5.14	4.84	4.90	4.87	6.06	5.09	5.10
18	4.62	4.60	5.04	5.16	5.46	5.04	4.85	4.81	4.84	6.16	5.05	5.06
19	4.62	4.56	5.00	5.16	5.61	5.00	4.86	4.82	4.84	6.06	5.04	5.04
20	4.62	4.60	5.05	5.15	5.70	4.97	4.86	4.82	4.83	6.00	5.02	5.02
21	4.62	4.62	5.06	5.14	5.76	4.96	4.86	4.80	4.82	5.98	5.00	5.00
22	4.58	4.63	5.05	5.14	5.84	4.94	4.84	4.80	4.82	5.82	5.00	4.98
23	4.62	4.64	5.04	5.12	5.91	4.91	4.85	4.80	4.81	5.73	4.98	4.98
24	4.62	4.64	5.04	5.02	5.88	4.90	4.86	4.79	4.81	5.66	5.00	4.99
25	4.60	4.64	5.04	4.94	5.78	5.12	4.84	4.79	4.82	5.62	5.00	4.98
26	4.60	4.56	5.00	4.92	5.52	5.19	4.81	4.80	4.82	5.54	5.00	5.00
27	4.60	4.62	5.04	4.92	5.40	5.12	4.80	4.81	4.82	5.48	5.00	5.00
28	4.60	4.64	5.04	4.94	5.31	5.02	4.80	4.80	4.82	5.41	4.99	4.98
29	4.55	.....	5.03	4.94	5.18	5.08	4.78	4.78	4.86	5.36	4.97	5.03
30	4.58	.....	5.02	4.92	5.11	5.11	4.78	4.77	4.86	5.29	4.96	5.10
31	4.59	.....	5.02	.....	5.14	.....	4.78	4.80	.....	5.24	.....	5.18

NOTE.—Discharge measurements show that the relation of gage height to discharge is probably not affected by ice.

Daily discharge, in second-feet, of Crow River at Rockford, Minn., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	67	40	51	151	128	225	179	85	85	104	209	144
2	62	40	51	131	131	194	151	90	80	101	138	144
3	56	40	49	148	125	202	134	98	80	131	165	144
4	54	43	51	151	118	202	115	93	85	162	187	144
5	58	34	38	151	118	500	112	90	90	405	194	141
6	58	40	52	151	109	415	125	90	90	665	198	144
7	51	38	54	151	107	405	122	90	90	881	198	138
8	52	40	58	154	112	395	118	96	90	905	194	144
9	51	38	67	148	107	336	125	107	90	695	209	144
10	51	40	71	154	101	266	131	98	85	472	179	158
11	51	40	88	190	107	249	128	88	118	395	125	151
12	51	38	104	202	107	213	125	80	131	385	112	151
13	51	40	118	217	101	225	118	96	162	365	165	158
14	49	40	128	202	98	158	112	98	158	365	158	158
15	43	41	131	209	131	154	101	98	144	365	165	165
16	47	43	151	209	154	194	96	128	125	385	162	179
17	47	43	158	206	187	194	96	112	104	643	176	179
18	47	43	158	202	327	158	98	88	96	701	162	165
19	47	38	144	202	400	144	101	90	96	643	158	158
20	47	43	162	198	445	134	101	90	93	610	151	151
21	47	47	165	194	478	131	101	85	90	599	144	144
22	40	49	162	194	522	125	96	85	90	511	144	138
23	47	51	158	187	560	115	98	85	88	462	138	138
24	47	51	158	151	544	115	101	83	88	425	144	141
25	43	51	158	125	489	187	96	83	90	405	144	138
26	43	38	144	118	355	213	88	85	90	365	144	144
27	43	47	158	118	300	187	85	88	90	336	144	144
28	43	51	158	125	261	151	85	85	90	304	141	138
29	34	.....	154	125	209	172	80	80	101	283	134	154
30	40	.....	151	118	183	183	80	78	101	253	131	179
31	41	.....	151	.....	194	.....	80	85	.....	233	.....	209

NOTE.—Daily discharge determined by means of a discharge rating curve that is well defined between 62 and 3,670 second-feet (gage heights 4.7 and 10 feet).

Monthly discharge of Crow River at Rockford, Minn., for 1911.

[Drainage area, 2,520 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	67	34	48.6	0.019	0.02	B.
February	51	34	42.4	.017	.02	B.
March	165	38	116	.046	.05	A.
April	217	118	166	.066	.07	A.
May	560	98	229	.091	.10	A.
June	500	115	218	.087	.10	A.
July	179	80	109	.043	.05	A.
August	128	78	91.2	.036	.04	A.
September	162	80	100	.040	.04	A.
October	905	101	437	.173	.20	A.
November	209	112	160	.064	.07	A.
December	209	138	152	.060	.07	B.
The year	905	34	157	.062	.83	

SOUTH FORK OF CROW RIVER NEAR ROCKFORD, MINN.

Location.—At the highway bridge 3½ miles southwest of Rockford, in sec. 1, T. 118 N., R. 25 W.; no tributaries within several miles.

Records available.—June 15, 1909, to December 31, 1911.

Drainage area.—1,160 square miles.

Gage.—Vertical staff; datum unchanged.

Channel.—Slightly shifting.

Discharge measurements.—Made from the bridge except at low stages, when they are made by wading a short distance upstream.

Winter flow.—Observations are discontinued from December to March, inclusive, because of ice.

Regulation.—The nearest dam is that at Delano, which is merely used as a diversion dam by the Great Northern Railway Co. The control for the station is determined by the dam at Rockford. From July 27 to August 10, 1909, and from June 1 to December 31, 1911, the dam at Rockford was open, and the control was temporarily changed.

Discharge measurements of South Fork of Crow River near Rockford, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
June 15[a]	S. B. Soulé	0.72	12.8
Sept. 2[a]	do	.66	5.40
Dec. 22[b]	do	1.61	35.9

[a] Measurement made at wading section.
[b] Measurement made through complete ice cover 500 feet above gage. Average thickness ice at measured section, 0.47 foot.

Daily gage height, in feet, of South Fork of Crow River near Rockford, Minn., for 1911.

[Jacob Horsch, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.69	1.72	0.80	0.98	0.69	0.70	0.80	1.79	.....
2	.....	1.70	1.72	.70	.92	.86	.68	.80	1.60	.....
3	.....	1.70	1.71	.70	.91	.78	.68	1.00	1.56	1.4
4	.....	1.69	1.68	.80	.90	.74	.79	1.21	1.68	.....
5	1.14	1.69	1.65	.79	.90	.70	.91	1.28	1.64	.....
6	1.20	1.71	1.61	.76	.90	.70	.90	2.92	1.65	.....
7	1.28	1.69	1.61	.70	.90	.70	.90	4.09	1.61	1.4
8	1.40	1.72	1.65	.71	.90	.70	.86	3.68	1.54	.....
9	1.56	1.72	1.62	.71	.92	.70	.84	3.22	1.51	.....
10	1.64	1.72	1.59	.70	.90	.70	.81	2.88	1.56	.....
11	1.69	1.76	1.50	.70	.88	.70	1.00	2.62	1.48	1.55
12	1.69	1.79	1.46	.64	.84	.70	1.55	2.44	.....	.....
13	1.71	1.80	1.36	.62	.81	.71	1.52	2.32	.....	.....
14	1.81	1.80	1.45	.61	.79	.94	1.29	2.32	.....	1.68
15	1.68	1.81	1.65	.72	.79	1.15	1.09	2.40	.....	.....
16	1.74	1.84	1.80	.81	.79	1.38	1.01	2.65	.....	.....
17	1.72	1.84	1.80	.80	.80	1.19	.96	3.38	.....	.....
18	1.70	1.82	1.99	.72	.76	1.05	.90	3.38	.....	1.62
19	1.72	1.85	2.12	.69	.75	.94	.88	3.16	.....	.....
20	1.71	1.81	2.20	.62	.74	.85	.84	2.92	.....	.....
21	1.78	1.81	2.22	.64	.70	.81	.85	2.76	.....	1.6
22	1.81	1.76	2.25	.61	.70	.80	.85	2.65	.....	1.61
23	1.78	1.75	2.30	.61	.70	.78	.80	2.52	1.42	.....
24	1.71	1.71	2.29	.62	.70	.71	.79	2.41	1.40	.....
25	1.71	1.72	2.21	.88	.70	.70	.76	2.16	1.40	.....
26	1.75	1.71	2.06	1.24	.70	.70	.75	2.11	1.4	1.58
27	1.71	1.70	1.96	1.04	.70	.70	.75	2.08	1.42	.....
28	1.74	1.72	1.91	1.16	.64	.70	.79	2.00	.....	1.5
29	1.72	1.72	1.86	1.12	.61	.70	.80	1.95	1.38	.....
30	1.71	1.74	1.81	1.02	.62	.70	.80	1.91	.....	.....
31	1.70	.....	1.79	.....	.64	.70	.....	1.88	.....	.....

NOTE.—Relation of gage height to discharge affected by ice about Jan. 1 to Feb. 28 and Nov. 12 to Dec. 31. Relation of gage height to discharge changed June 1 because of change in control caused by dam at Rockford being destroyed.

Daily discharge, in second-feet, of South Fork of Crow River near Rockford, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	20	78	81	80	29	12	6	10	89
2	20	79	81	65	24	21	5.3	10	68
3	20	79	80	60	24	16	5.3	19	64
4	25	78	77	55	23	10	10	33	77
5	28	78	74	50	23	8	14	38	72
6	32	80	69	45	23	8	14	272	74
7	38	78	69	40	23	8	14	557	69
8	49	81	74	35	23	8	12	450	62
9	64	81	70	30	21	8	12	341	59
10	72	81	67	25	23	8	10	264	64
11	78	86	58	20	22	8	19	212	56
12	78	89	54	15	19	8	63	180	.....
13	80	90	45	13	18	8	60	160	.....
14	91	90	54	12	16	20	39	160	.....
15	77	91	74	13	16	34	24	173	.....
16	83	95	90	12	16	51	20	218	.....
17	81	95	90	12	17	36	17	378	.....
18	79	92	114	13	15	27	14	378	.....
19	81	96	131	12	14	20	13	329	.....
20	80	91	142	8	12	15	12	272	.....
21	88	91	145	9	10	14	12	239	.....
22	91	86	150	8	10	13	12	218	.....
23	88	84	157	8	10	12	10	194	.....
24	80	80	156	8	10	8	10	175	.....
25	80	81	144	22	10	6	8	136	.....
26	84	80	123	48	10	6	8	129	.....
27	80	79	110	33	10	6	8	125	.....
28	83	81	103	42	6	6	10	115	.....
29	81	81	97	39	4	6	10	108	.....
30	80	83	91	31	5	6	10	103	.....
31	79	.....	89	.....	6	6	.....	100	.....

NOTE.—Daily discharge computed from a fairly well defined rating curve, which was applied indirectly from June 1 to Aug. 31. Daily discharge Mar. 1 to 4 estimated. Discharge Nov. 12 to Dec. 31 estimated, because of ice, from one discharge measurement, gage observer's notes, climatologic records, and discharge of adjacent drainage areas. Mean discharge Nov. 12 to 30 estimated 25 second-feet, varying from about 20 to 45 second-feet. Mean discharge Dec. 1 to 31 estimated 35 second-feet, varying from about 15 to 45 second-feet.

Monthly discharge of South Fork of Crow River near Rockford, Minn., for 1911.

[Drainage area, 1,170 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
March	91	20	67.4	0.057	0.07	B.
April	96	78	84.5	.072	.08	B.
May	157	45	95.5	.082	.09	B.
June	80	8	28.8	.024	.03	C.
July	29	4	16.0	.014	.02	C.
August	51	6	13.6	.012	.01	B.
September	63	5.3	16.1	.014	.02	B.
October	557	10	197	.168	.19	B.
November	89	.....	41.0	.035	.04	C.
December	.....	.....	35.0	.030	.03	D.

NOTE.—See footnotes to table of daily discharge.

RUM RIVER AT ONAMIA, MINN.

Location.—At the steel highway bridge at Onamia, 200 yards below the outlet of Lake Onamia and 5 miles above the mouth of Bradbury Brook.

Records available.—September 24, 1909, to December 31, 1911.

Drainage area.—414 square miles, of which 207 square miles are taken up by the water surface of Mille Lacs Lake.

Gage.—Vertical staff. The gage was located originally at the wooden highway bridge just below the "Soo" Railway bridge, but May 4, 1910, this bridge was destroyed and the gage moved 200 yards downstream to the steel highway bridge. The new gage was set to read the same as the old one.

Channel.—Practically permanent, except as affected by grass.

Discharge measurements.—Made from the steel highway bridge.

Winter flow.—At the original location gage heights were practically unaffected by ice. At the present location, however, the river freezes over.

Regulation.—Two miles below Onamia is an abandoned logging dam which raises the water level about 3 feet but does not control the flow. As there is a good fall to the river the influence of this dam does not reach the gaging station. Owing to the natural storage afforded by the lakes, the range of stage at Onamia is slight.

Accuracy.—The extremely low water of 1911 was favorable to the growth of grass in the river channel. This growth created an appreciable backwater effect at the gage, and therefore the records for that period are not as reliable as during the remainder of the year.

Discharge measurements of Rum River at Onamia, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
June 30	S. B. Soulé	0.40	5.2
30	.....do	.40	5.2
Sept. 1	.....do	− .04	.67
Oct. 25	.....do	.38	16.6

NOTE.—All 1911 measurements made by wading.

Daily gage height, in feet, of Rum River at Onamia, Minn., for 1911.

[R. Swedburg, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.30	0.38	0.25	0.45	0.05	−0.05	0.20	0.35	0.25
2	.30	.35	.28	.45	.05	− .02	.20	.35	.25
3	.30	.32	.32	.42	.08	− .02	.22	.35	.25
4	.32	.30	.34	.42	.08	− .02	.22	.35	.25
5	.32	.28	.35	.42	.08	− .02	.22	.35	.25
6	.32	.25	.38	.40	.08	.00	.25	.35	.25
7	.35	.22	.40	.38	.05	.00	.28	.35	.22
8	.35	.25	.42	.38	.05	.00	.30	.32	.22
9	.38	.25	.45	.35	.05	.00	.30	.32	.22
10	.38	.25	.48	.32	.02	.02	.32	.32	.20
11	.40	.22	.48	.30	.02	.02	.32	.32	.20
12	.40	.22	.48	.28	.02	.02	.35	.30	.20
13	.42	.20	.48	.25	.02	.05	.38	.30	.20
14	.45	.22	.50	.22	.02	.07	.38	.30	.20
15	.48	.22	.50	.10	.05	.10	.40	.30	.20
16	.50	.25	.50	.10	.05	.12	.40	.30	.....
17	.50	.25	.50	.10	.05	.15	.40	.30	.....
18	.50	.28	.48	.10	.05	.15	.40	.30	.....
19	.50	.28	.48	.10	.05	.18	.38	.30	.....
20	.50	.30	.45	.10	.05	.18	.38	.28	.....
21	.50	.30	.45	.08	.05	.18	.40	.28	.....
22	.48	.28	.48	.08	.02	.18	.40	.28	.....
23	.48	.28	.48	.08	.02	.18	.40	.28	.....
24	.48	.25	.45	.05	.02	.18	.38	.28	.....
25	.45	.22	.45	.05	.02	.20	.38	.28	.....
26	.45	.22	.45	.05	.02	.20	.38	.28	.....
27	.42	.20	.45	.02	.00	.20	.38	.25	.....
28	.42	.20	.45	.02	.00	.20	.35	.25	.....
29	.42	.20	.45	.02	− .02	.20	.35	.25	.....
30	.40	.20	.44	.02	− .05	.20	.35	.25	.....
31	.....	.22	.....	.05	− .05	.....	.35	.....	.....

NOTE.—Ice present Jan. 1 to Mar. 20, and Dec. 16 to 31.

Daily discharge, in second-feet, of Rum River at Onamia, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.4	4.8	2.9	7.4	1.2	0.6	6.0	14.5	8.5
2	.....	3.4	4.3	3.2	7.4	1.2	.7	6.0	14.5	8.5
3	.....	3.4	3.8	3.8	6.1	1.4	.7	7.0	14.5	8.5
4	.....	3.8	3.4	4.1	6.1	1.4	.7	7.0	14.5	8.5
5	.....	3.8	3.2	4.3	6.1	1.4	.7	7.0	14.5	8.5
6	.....	3.8	2.9	4.8	5.2	1.4	.8	8.5	14.5	8.5
7	.....	4.3	2.6	5.2	4.8	1.2	.8	10.0	14.5	7.0
8	.....	4.3	2.9	6.1	4.8	1.2	.8	11.0	12.4	7.0
9	.....	4.8	2.9	7.4	4.3	1.2	.8	11.0	12.4	7.0
10	.....	4.8	2.9	8.6	3.8	.9	1.0	12.4	12.4	6.0
11	.....	5.2	2.6	8.6	3.4	.9	1.1	12.4	12.4	6.0
12	.....	5.2	2.6	8.6	3.2	.9	1.2	14.5	11.0	6.0
13	.....	6.1	2.4	8.6	2.9	.9	1.5	16.6	11.0	6.0
14	.....	7.4	2.6	9.5	2.6	.9	2.4	16.6	11.0	6.0
15	.....	8.6	2.6	9.5	1.5	1.2	3.0	18.0	11.0	6.0
16	.....	9.5	2.9	9.5	1.5	1.2	3.6	18.0	11.0	.....
17	.....	9.5	2.9	9.5	1.5	1.2	4.5	18.0	11.0	.....
18	.....	9.5	3.2	8.6	1.5	1.2	4.5	18.0	11.0	.....
19	.....	9.5	3.2	8.6	1.5	1.2	5.4	16.6	11.0	.....
20	.....	9.5	3.4	7.4	1.5	1.2	5.4	16.6	10.0	.....
21	1	9.5	3.4	7.4	1.4	1.2	5.4	18.0	10.0	.....
22	2	8.6	3.2	8.6	1.4	.9	5.4	18.0	10.0	.....
23	3	8.6	3.2	8.6	1.4	.9	5.4	18.0	10.0	.....
24	3	8.6	2.9	7.4	1.2	.9	5.4	16.6	10.0	.....
25	3	7.4	2.6	7.4	1.2	.9	6.0	16.6	10.0	.....
26	3	7.4	2.6	7.4	1.2	.9	6.0	16.6	10.0	.....
27	3	6.1	2.4	7.4	.9	.8	6.0	16.6	8.5	.....
28	3	6.1	2.4	7.4	.9	.8	6.0	14.5	8.5	.....
29	3	6.1	2.4	7.4	.9	.7	6.0	14.5	8.5	.....
30	3	5.2	2.4	6.9	.9	.6	6.0	14.5	8.5	.....
31	3	.....	2.6	.....	1.2	.6	.....	14.5	.....	.....

NOTE.—Daily discharge computed from two rating curves not well defined except from Jan. 1 to Mar. 20, when there was no flow, as the river was frozen to the bottom. Discharge Jan. 1 to Mar. 31 and Dec. 16 to 31 estimated, because of ice, from observer's notes, climatologic records, and discharge of adjacent drainage areas. Mean discharge Dec. 16 to 31 estimated 3 second-feet, varying from about 0 to 6 second-feet.

Monthly discharge of Rum River at Onamia, Minn., for 1911.

[Drainage area, 414 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	0.0	0.0	0.00	0.0000	0.000	B.
February	.0	.0	.00	.0000	.000	B.
March	3	.0	.97	.0023	.003	B.
April	9.5	3.4	6.45	.016	.02	C.
May	4.8	2.4	2.97	.0072	.008	C.
June	9.5	2.9	7.16	.017	.02	C.
July	7.4	.9	2.89	.0070	.008	C.
August	1.4	.6	1.05	.0025	.003	C.
September	6.0	.6	3.26	.0079	.009	B.
October	18.0	6.0	13.9	.034	.04	B.
November	14.5	8.5	11.4	.028	.03	C.
December	8.5	.0	5.03	.012	.01	D.
The year	18.0	.0	4.60	.011	.15	

NOTE.—See footnote to table of daily discharge.

RUM RIVER AT CAMBRIDGE, MINN.

Location.—At highway bridge one-half mile west of Cambridge. No tributary within several miles.

Records available.—June 12, 1909, to December 31, 1911.

Drainage area.—1,160 square miles.

Gage.—Vertical staff; datum unchanged since established.

Channel.—Somewhat changeable, as shown by low-water measurements.

Discharge measurements.—Made from the bridge.

Winter flow.—From December to March, discharge measurements are made through ice to determine the winter flow.

Regulation.—At St. Francis, 20 miles below Cambridge by river, there is a 10-foot dam and power plant. Between the crest of the dam and the water surface at the gaging station there is a difference in elevation of about 6 feet. The fact that morning and evening gage heights during the low-water period show no consistent change, being for the most part the same, indicates that the St. Francis dam has very little effect on the flow at this station, even though the flow may fall below the crest during certain portions of the day. The only dam above Cambridge is one at Milaca, which is used to form a pool from which water is pumped.

Accuracy.—During the summer of 1911 grass grew in the channel to such an extent that it caused backwater in varying amounts at the gage. The records for that period, therefore, can not be considered better than fair. The remainder of the records are believed to be good.

Discharge measurements of Rum River at Cambridge, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Mar. 2[a]	C. R. Adams	3.16	62.7
June 2	Robert Follansbee	3.10	147
Aug. 29[b]	S. B. Soulé	3.31	59.8
Oct. 14[b]	do	4.01	285
Nov. 27[c]	W. G. Hoyt	3.30	110
27[c]	S. B. Soulé	3.30	114
Dec. 27[d]	do	3.45	114

[a] Measurement made under ice cover.
[b] Grass and moss in channel.
[c] Measurement under ice condition, 92 per cent ice cover; average thickness of ice, 0.51 foot; average distance water surface to top of ice, 0.01 foot.
[d] Measurement made under complete ice cover. Average thickness of ice, 0.64 foot; average gage height to top of ice, 3.51.

Daily gage height, in feet, of Rum River at Cambridge, Minn., for 1911.

[Martin Lofstrom, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	2.70	2.76	3.16	3.92	3.74	3.36	3.21	3.31	3.28
2	.....	.....	3.15	2.70	2.78	3.11	3.85	3.84	3.36	3.20	3.15	.....
3	3.00	3.15	3.20	2.66	2.74	3.14	3.74	3.90	3.30	3.32	3.19	.....
4	.....	.....	.....	2.65	2.71	3.25	3.70	3.96	3.28	3.49	3.24	3.28
5	.....	.....	.....	2.71	2.72	3.40	3.84	3.99	3.31	3.49	3.02	.....
6	3.02	.....	.....	2.72	2.71	3.45	3.90	4.05	3.38	3.71	3.21	.....
7	.....	3.15	3.15	2.69	2.68	4.80	3.85	3.98	3.36	3.95	3.12	3.30
8	.....	.....	.....	2.72	2.62	4.98	3.80	3.99	3.39	4.00	3.08	.....
9	.....	.....	3.22	2.74	2.62	4.72	3.76	4.00	3.41	4.40	3.05	.....
10	3.08	3.18	3.28	2.76	2.64	4.46	3.69	3.96	3.48	4.70	3.05	.....

Daily gage height, in feet, of Rum River at Cambridge, Minn., for 1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	.....	.....	3.20	2.79	2.68	4.29	3.59	3.90	3.65	4.68	2.98	3.48
12	.....	.....	3.34	2.96	2.62	4.25	3.54	3.89	3.75	4.45	.....	.....
13	3.08	.....	3.20	3.24	2.61	4.21	3.46	3.89	3.64	4.20	3.08	.....
14	.....	3.20	3.14	3.31	2.62	4.11	3.42	3.94	3.58	4.01	.....	3.50
15	.....	.....	3.51	3.29	3.12	4.04	3.39	3.95	3.56	3.85	.....	.....
16	.....	.....	3.24	3.26	3.65	4.01	3.36	3.90	3.58	3.80	3.12	.....
17	3.10	3.15	3.14	3.18	3.75	3.96	3.35	3.85	3.51	4.06	.....	.....
18	.....	.....	3.12	3.05	3.92	3.94	3.38	3.81	3.66	4.31	.....	3.48
19	.....	.....	2.98	3.18	4.04	3.90	3.40	3.79	3.82	4.48	.....	.....
20	3.12	.....	2.92	3.28	4.11	3.88	3.41	3.78	3.80	4.60	3.18	.....
21	.....	3.12	2.94	3.22	4.50	3.85	3.42	3.74	3.76	4.54	.....	3.45
22	.....	.....	2.78	3.18	4.99	3.82	3.42	3.61	3.69	4.36	.....	.....
23	.....	.....	2.76	3.12	4.84	3.79	3.41	3.54	3.54	4.19	3.25	.....
24	3.15	3.15	2.80	3.02	4.49	3.74	3.42	3.46	3.38	4.04	.....	.....
25	.....	.....	2.75	3.00	4.24	3.70	3.45	3.42	3.29	3.92	.....	.....
26	.....	.....	2.81	2.95	4.20	3.71	3.46	3.44	3.22	3.82	.....	3.45
27	3.15	.....	2.82	2.91	3.96	3.71	3.45	3.38	3.16	3.76	3.30	3.45
28	.....	3.20	2.90	2.89	3.68	3.70	3.55	3.34	3.21	3.69	.....	.....
29	.....	.....	2.81	2.85	3.48	3.78	3.56	3.32	3.28	3.60	.....	3.42
30	.....	.....	2.75	2.81	3.35	3.88	3.64	3.34	3.25	3.48	.....	.....
31	3.15	.....	2.74	.....	3.24	.....	3.65	3.36	.....	3.39	.....	.....

NOTE.—Ice present Jan. 1 to Mar. 9; average thickness of ice, 1 to 1.5 feet; and Nov. 11 to Dec. 31, average thickness of ice, 0.2 to 0.6 foot.

Daily discharge, in second-feet, of Rum River at Cambridge, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	63	79	87	158	319	190	70	98	168
2	63	79	89	147	301	215	72	97	140
3	65	75	84	153	275	240	68	116	146
4	70	72	80	176	262	242	76	150	157
5	75	80	82	209	299	251	80	150	118
6	80	81	80	220	302	247	90	195	155
7	100	78	77	569	287	232	88	254	139
8	125	82	69	619	275	233	89	216	135
9	150	84	69	547	265	233	96	370	130
10	183	87	71	474	246	225	115	455	130
11	166	91	77	428	220	196	145	450	.....
12	196	118	69	418	200	195	165	395	.....
13	166	174	68	407	182	194	152	345	.....
14	153	189	69	381	172	205	141	285	.....
15	233	185	149	362	169	205	139	251	.....
16	174	179	266	355	156	190	145	240	.....
17	153	162	290	342	151	172	131	305	.....
18	149	135	332	337	157	161	158	380	.....
19	121	162	362	327	160	160	198	425	.....
20	111	183	381	322	161	158	194	455	.....
21	114	174	485	314	155	135	183	450	.....
22	89	162	622	307	151	113	176	400	.....
23	87	149	580	300	150	104	146	360	.....
24	92	129	482	288	150	91	120	325	.....
25	86	125	415	278	155	84	107	295	.....
26	94	116	404	280	148	72	97	271	.....
27	95	80	342	280	145	68	87	260	.....
28	107	106	273	278	164	64	98	245	.....
29	94	100	227	297	165	60	107	225	.....
30	86	109	198	322	180	62	105	202	.....
31	84	.....	174	.....	180	64	.....	183	.....

NOTE.—Daily discharge computed from a rating curve not well defined, which was applied indirectly owing to shifting of channel. Daily discharge estimated Mar. 1 to 9. Discharge Nov. 11 to Dec. 31 estimated, because of ice, on basis of three discharge measurements, gage observer's notes, and climatologic records. Mean discharge Nov. 11 to 30 estimated 117 second-feet, varying from about 110 to 127 second-feet. Mean discharge Dec. 1 to 31 estimated 114 second-feet.

Monthly discharge of Rum River at Cambridge, Minn., for 1911.

[Drainage area, 1,160 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	[a] 45.0	0.039	0.04	C.
February	.....	.....	[a] 55.0	.047	.05	D.
March	233	[a] 63	117	.101	.12	C.
April	189	72	121	.104	.12	B.
May	622	68	228	.197	.23	B.
June	619	147	330	.284	.32	B.
July	319	145	203	.175	.20	D.
August	251	60	163	.141	.16	C.
September	198	68	121	.104	.12	C.
October	455	97	285	.246	.28	C.
November	168	[b] 110	125	.108	.12	C.
December	.....	.....	[b] 114	.098	.11	C.
The year	622	.....	160	.138	1.87	

[a] Estimated from two ice measurements and semiweekly gage heights.
[b] Estimated.

NOTE.—See footnotes to table of daily discharge.

MINNESOTA RIVER BASIN.

MINNESOTA RIVER NEAR ODESSA, MINN.

Location.—At highway bridge 1 mile southwest of Odessa in sec. 32, T. 121 N., R. 45 W., half a mile below the mouth of Stony Run, a very small stream entering from the north.

Records available.—July 4, 1909, to November 19, 1911.

Drainage area.—1,560 square miles.

Gage.—Chain, attached to bridge; datum unchanged since established.

Channel.—Practically permanent except during periods of high water.

Discharge measurements.—Made from the bridge, except during low stages, when they are made at a wading section.

Winter flow.—The river is frozen over and observations are discontinued from December to March. The flow during that period may possibly be estimated by using the run-off per square mile of drainage area above Montevideo. (See p. 98.)

Regulation.—The flow at Odessa is entirely uncontrolled, as the nearest dam is at Granite Falls.

This station was established in order to determine the run-off from Big Stone Lake available for storage and the amount of flood water contributed by the upper valley. As Whetstone River enters Minnesota River above Odessa a station was established on that stream also for the purpose of determining the amount of water passing Odessa from that source.

Owing to its extreme flatness the valley immediately below Big Stone Lake is subject to severe overflow during high water, and therefore it was not possible to select a satisfactory station site above Odessa. Even at this point extremely high water overflows around one end of the bridge, but the amount is only a small percentage of the entire flow.

Discharge measurements of Minnesota River near Odessa, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
May 6	C. J. Emerson	2.32	20.9
Aug. 4[a]	S. B. Soulé	2.09	8.23

[a] Measurement made by wading at section about 100 feet above the bridge. Channel obstructed by grass and moss.

Daily gage height, in feet, of Minnesota River near Odessa, Minn., for 1911.

[Claud Shellenbarger, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.91	2.48	2.05	1.94	1.91	1.78	2.24	2.45
2	.....	3.06	2.48	2.09	1.89	1.84	1.76	2.30	2.45
3	.....	2.78	2.47	2.12	.....	1.95	1.76	2.41	2.45
4	.....	2.77	2.47	2.82	.....	2.09	1.82	2.84	2.52
5	.....	2.85	2.46	2.68	.....	2.01	1.82	2.55	2.42
6	.....	2.82	2.37	2.58	1.98	1.99	1.88	2.58	2.40
7	.....	2.88	2.36	2.52	1.90	2.04	2.08	2.55	2.40
8	.....	2.86	2.40	2.30	1.84	2.00	2.21	2.39	2.38
9	.....	2.76	2.46	2.20	1.85	1.96	2.10	2.32	2.40
10	.....	2.70	2.34	2.15	1.81	2.00	2.20	2.35	2.40
11	.....	2.46	2.40	2.09	1.80	1.94	2.05	2.39	.....
12	.....	3.08	2.38	2.22	1.82	1.88	2.05	2.35	.....
13	.....	3.65	2.21	2.16	1.79	1.85	2.02	2.39	.....
14	.....	3.38	2.12	2.12	1.74	1.86	1.98	2.36	.....
15	.....	3.14	2.30	1.98	1.74	1.86	1.91	2.40	.....
16	.....	3.00	2.38	2.02	1.75	1.90	1.85	2.56	.....
17	.....	2.90	2.15	2.00	1.72	1.85	1.84	2.65	.....
18	.....	2.68	2.20	1.95	1.78	1.84	2.10	2.49	.....
19	4.71	2.66	2.36	1.92	1.86	1.85	2.00	2.48	.....
20	4.62	2.66	2.40	1.89	1.86	1.85	1.95	2.49	.....
21	4.51	2.67	2.48	1.85	1.81	1.85	1.94	2.50	.....
22	4.46	2.65	2.16	1.90	1.81	1.84	2.06	2.36	.....
23	4.12	2.66	2.25	1.88	1.84	1.82	2.12	2.35	.....
24	3.66	2.51	2.11	1.90	1.80	1.80	2.02	2.36	.....
25	3.37	2.50	2.06	1.82	1.76	1.78	1.98	2.35	.....
26	4.48	2.48	2.19	1.82	1.71	1.79	1.92	2.40	.....
27	4.74	2.47	2.12	1.86	1.70	1.84	1.90	2.39	.....
28	2.71	2.48	2.11	1.96	1.71	1.86	2.06	2.35	.....
29	2.51	2.57	2.15	2.10	1.70	1.81	2.24	2.36	.....
30	2.51	2.47	2.08	2.04	1.70	1.80	2.25	2.50	.....
31	2.50	.....	2.09	.....	1.74	1.80	.....	2.48	.....

NOTE.—Ice present Jan. 1 to Mar. 18 and Nov. 11 to Dec. 31.

Daily discharge, in second-feet, of Minnesota River near Odessa, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	49	25	13	9	6	5	17	24
2	.....	58	25	14	8	5	5	19	24
3	.....	41	25	14	8	6	5	22	24
4	.....	40	25	43	9	9	6	44	27
5	.....	45	24	35	9	7	6	28	23
6	.....	43	21	30	10	7	6	30	22
7	.....	47	21	27	8	8	9	28	22
8	.....	46	22	19	7	7	11	22	21
9	.....	40	24	16	7	6	9	20	22
10	.....	36	20	15	6	7	11	20	22
11	.....	24	22	14	6	6	8	22	.....
12	.....	59	21	17	6	6	8	20	.....
13	.....	94	16	15	6	6	7	22	.....
14	.....	77	14	14	5	6	7	21	.....
15	.....	62	19	12	5	6	6	22	.....

Daily discharge, in second-feet, of Minnesota River near Odessa, Minn., for 1911—Con.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
16	.....	54	21	12	5	6	6	29	.....
17	.....	48	15	12	5	6	6	34	.....
18	.....	35	16	11	5	6	9	26	.....
19	180	34	21	10	6	6	7	25	.....
20	172	34	22	10	6	6	6	26	.....
21	162	34	25	9	6	6	6	26	.....
22	157	34	15	10	6	6	8	21	.....
23	130	34	18	10	6	6	9	20	.....
24	95	26	14	10	6	6	7	21	.....
25	76	26	13	8.4	6	6	7	20	.....
26	159	25	16	8.4	5	6	6	22	.....
27	183	25	14	9.2	5	6	8	22	.....
28	37	25	14	11	5	6	11	20	.....
29	26	30	15	14	5	6	15	21	.....
30	26	25	14	13	5	6	16	26	.....
31	26	.....	14	.....	5	6	.....	25	.....

NOTE.—Daily discharge computed from a well-defined rating curve which was applied indirectly from July 1 to Sept. 30 on account of obstruction in channel.

Monthly discharge of Minnesota River near Odessa, Minn., for 1911.

[Drainage area, 1,560 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
Mar. 19-31	183	26	110	0.071	0.03	B.
April	94	24	41.7	.027	.03	A.
May	25	13	19.1	.012	.01	A.
June	43	8.4	15.2	.0097	.01	A.
July	10	5	6.3	.0040	.005	B.
August	9	5	6.3	.0040	.005	B.
September	16	5	7.9	.0051	.006	B.
October	44	17	23.9	.015	.02	B.
Nov. 1-10	27	21	23.1	.015	.006	B.

MINNESOTA RIVER NEAR MONTEVIDEO, MINN.

Location.—At the highway bridge 1 mile south of Montevideo, in sec. 19, T. 117 N., R 40 W., a short distance below the mouth of Chippewa River.

Records available.—July 23, 1909, to December 31, 1911.

Drainage area.—6,300 square miles.

Gage.—Chain, attached to bridge. The datum of the gage was lowered 2 feet September 16, 1909, and 1 foot additional July 29, 1910, to avoid negative readings. All gage heights have been referred to the last datum.

Channel.—Practically permanent.

Discharge measurements.—Made from the bridge.

Winter flow.—The river is frozen over from December to March, and measurements are made through the ice to determine the winter discharge.

Regulation.—The nearest dam is at Granite Falls, but its influence does not extend to the Montevideo station. There is no dam above the station. The discharge of Chippewa River is so much less than that of the Minnesota that the control of the former by a dam at Montevideo has very little effect on the Minnesota gage heights.

Discharge measurements of Minnesota River near Montevideo, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Jan. 10[a]	C. J. Emerson	2.48	28.6
May 5	do	2.90	180
Aug. 5[b]	S. B. Soulé	1.57	42.8
Dec. 8[c]	C. J. Emerson	3.00	112

[a] Measurement made under ice cover.
[b] Measurement made by wading.
[c] Measurement made under complete ice cover. Average thickness of ice, 0.70 foot. Average distance water surface to top of ice, 0.12 foot.

Daily gage height, in feet, of Minnesota River near Montevideo, Minn., for 1911.

[Miss Margaret Hendricks, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.90	3.35	3.24	3.24	2.68	2.29	1.46	1.66	2.14	2.76	3.20
2	.....	.....	.....	3.26	3.16	2.26	2.17	1.49	1.72	2.11	2.59	.....
3	.....	.....	.....	3.26	3.14	2.29	2.46	1.53	1.65	2.22	3.05	.....
4	2.48	2.88	3.38	3.21	3.09	2.74	2.28	1.36	1.78	2.31	3.36	3.10
5	.....	.....	.....	3.24	2.99	3.45	2.12	1.55	1.85	2.34	3.39	.....
6	.....	.....	.....	3.26	3.04	3.19	2.47	1.58	1.92	2.29	3.44	.....
7	2.60	.....	.....	3.26	2.60	3.51	2.04	1.65	1.82	2.60	3.39	.....
8	.....	2.92	3.32	3.29	2.69	3.39	1.89	1.72	1.92	2.71	3.30	.....
9	.....	.....	3.31	3.26	2.89	3.40	1.73	1.71	2.18	2.64	3.16	3.00
10	2.49	.....	3.29	3.22	2.94	3.46	2.14	1.72	2.20	2.49	3.24	.....
11	.....	3.00	3.25	3.26	2.89	3.00	2.08	1.74	2.29	2.25	3.19	3.20
12	.....	.....	3.58	3.31	2.84	3.61	2.12	1.63	2.24	2.19	.....	.....
13	.....	.....	3.68	3.41	2.76	3.20	1.94	1.56	2.06	2.48	.....	.....
14	2.68	.....	3.88	3.51	2.71	3.18	1.89	1.56	2.09	2.69	.....	.....
15	.....	3.15	3.96	3.61	2.76	2.71	1.83	1.55	2.25	2.36	.....	3.00
16	.....	.....	3.32	3.62	2.72	2.76	1.69	1.69	2.19	2.58	2.88	.....
17	.....	.....	3.22	3.56	2.74	3.12	1.79	1.74	1.91	2.74	.....	.....
18	2.70	3.38	3.34	3.54	2.76	2.79	1.72	1.61	1.86	2.84	.....	3.28
19	.....	.....	3.31	3.59	2.71	3.31	1.69	1.56	1.96	2.59	.....	.....
20	.....	.....	3.26	3.64	3.19	2.76	1.67	1.56	2.01	2.55	3.32	.....
21	2.78	.....	3.30	3.66	3.06	2.56	1.65	1.61	2.04	2.68	.....	.....
22	.....	3.22	3.34	3.69	2.95	2.74	1.73	1.55	1.99	3.28	.....	3.25
23	.....	.....	3.35	3.24	2.76	2.71	1.63	1.54	1.99	3.59	.....	.....
24	.....	.....	3.36	3.24	2.71	2.61	1.87	1.65	1.90	3.04	3.65	.....
25	2.68	3.30	3.41	3.21	2.79	2.58	1.92	1.52	1.82	3.16	.....	3.38
26	2.80	.....	3.49	3.29	2.61	2.59	1.66	1.59	1.91	3.22	.....	.....
27	.....	.....	3.58	3.26	2.88	2.79	1.47	1.46	2.01	3.26	3.22	.....
28	2.70	.....	3.52	3.19	2.86	2.79	1.41	1.81	2.01	3.29	.....	.....
29	.....	.....	3.36	3.06	2.79	2.19	1.36	1.76	2.06	3.51	.....	3.30
30	.....	.....	3.31	3.19	2.85	2.41	1.38	1.68	2.21	3.66	.....	.....
31	.....	.....	3.29	.....	2.79	.....	1.43	1.61	.....	3.48	.....	.....

NOTE.—Ice present Jan. 1 to Mar. 7, average thickness of ice 1 foot, and Nov. 11 to Dec. 31, average thickness of ice 0.3 foot. On Dec. 11 gage observer noted: "River open on account of recent warm weather and swift current."

Daily discharge, in second-feet, of Minnesota River near Montevideo, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	100	242	242	166	119	33	50	101	176
2	125	246	230	115	105	35	56	98	155
3	150	246	227	119	139	39	50	110	214
4	150	238	220	173	118	25	62	121	263
5	150	242	206	282	99	40	70	125	269
6	175	246	213	234	140	43	77	119	279
7	200	246	156	294	90	50	66	156	269
8	256	250	167	269	74	56	77	169	252
9	254	246	193	271	57	55	106	161	230
10	250	239	199	284	101	56	108	143	242
11	244	246	193	207	95	58	119	114	.....
12	310	254	186	316	99	48	113	107	.....
13	332	273	176	236	79	41	93	142	.....
14	379	294	169	233	74	41	96	167	.....
15	400	316	176	169	67	40	114	127	.....
16	256	318	171	176	53	53	107	154	.....
17	239	305	173	224	63	58	76	173	.....
18	260	301	176	180	56	46	71	186	.....
19	254	312	169	254	53	41	82	155	.....
20	246	323	234	176	51	41	87	150	.....
21	252	327	215	151	50	46	90	166	.....
22	260	334	200	173	57	40	85	249	.....
23	262	242	176	169	48	40	85	312	.....
24	263	242	169	157	72	50	75	213	.....
25	273	238	180	154	77	38	66	230	.....
26	290	250	157	155	50	44	76	239	.....
27	310	246	191	180	34	33	87	246	.....
28	296	234	189	180	29	65	87	250	.....
29	263	215	180	107	25	60	93	294	.....
30	254	234	188	133	27	52	109	327	.....
31	250	.....	180	.....	30	46	.....	288	.....

NOTE.—Daily discharge computed from well-defined rating curve. Daily discharge, Mar. 1 to 7, estimated. Discharge, Nov. 11 to Dec. 31, estimated, because of ice, from one discharge measurement, gage observer's notes, and climatologic records. Mean discharge, Nov. 11 to 30, estimated 130 second-feet, varying from about 110 to 200 second-feet. Mean discharge, Dec. 1 to 31, estimated 160 second-feet, varying from about 112 to 236 second-feet.

Monthly discharge of Minnesota River near Montevideo, Minn., for 1911.

[Drainage area, 6,300 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	[a] 40.0	0.0063	0.007	D.
February	.....	.....	[a] 50.0	.0079	.008	D.
March	400	100	248	.039	.04	B.
April	334	215	265	.042	.05	A.
May	242	156	190	.030	.03	A.
June	316	107	198	.031	.03	A.
July	140	25	72.0	.011	.01	A.
August	65	25	45.6	.0072	.008	A.
September	119	50	84.4	.013	.01	A.
October	327	98	180	.029	.03	B.
November	279	.....	165	.026	.03	C.
December	.....	.....	160	.025	.03	D.
The year	400	.....	142	.023	.28	

[a] Estimated from one ice measurement, semiweekly gage heights, and comparison with climatologic data.

NOTE.—See footnotes to table of daily discharge.

MINNESOTA RIVER NEAR MANKATO, MINN.

Location.—At Sibley Park, 2 miles above the center of Mankato; a few hundred yards below the mouth of Blue Earth River, the nearest tributary.

Records available.—May 20, 1903, to December 31, 1911. Since 1906 the gage heights have been furnished by the United States Weather Bureau.

Drainage area.—14,600 square miles.

Gage.—Chain, maintained by the United States Engineer Corps; datum unchanged since established.

Channel.—Fairly permanent except during periods of high water.

Discharge measurements.—Made from a boat and cable near the gage.

Winter flow.—From December to March, measurements are made through the ice to determine the winter discharge.

Regulation.—The nearest dam on the river is at Minnesota Falls, 140 miles upstream. There is no dam below the station. A dam on Blue Earth River at Rapidan a few miles above the mouth controls the flow of that river, but its flow is such a small part of the entire discharge at the Mankato station that the effect of such control is very slight.

Maximum and minimum flow.—The highest known stage of the river occurred in 1881 and is shown by a well-marked line in Mankato. The stage was approximately 27 feet above the zero of the present gage. This value was corroborated by M. B. Haynes, city engineer of Mankato, who states that the high water occurred after the ice went out and was not caused by backwater. The corresponding discharge was approximately 65,000 second-feet. Since the establishment of the gage the highest stage recorded was 21.2 feet on June 26, 1908. The lowest stage recorded was 0.6 in 1911, when the flow was about 160 second-feet for a considerable time.

Accuracy.—Measurements made during the earlier years indicated changing conditions of flow, and accordingly the discharge for years previous to 1907 was obtained largely by the indirect method. These results can not be considered as accurate as the later ones, which were based on a well-defined rating curve and show permanent channel.

Discharge measurements of Minnesota River near Mankato, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Feb. 22	C. R. Adams	1.59	[a] 200
June 21	S. B. Soulé	1.32	[b] 495
Aug. 2	.....do	.69	[b] 183
2	.....do	.69	[c] 188

[a] Measurement under ice cover.
[b] Wading measurement at cable section.
[c] Wading measurement about 500 feet below cable.

Daily gage height, in feet, of Minnesota River near Mankato, Minn., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.9	1.4	1.7	1.9	1.6	1.3	1.0	0.8	0.5	0.9	2.9	1.9
2	.9	1.5	1.7	1.8	1.6	1.6	1.1	.8	.5	.8	2.8	1.9
3	.9	1.5	1.8	1.8	1.5	1.5	1.1	.6	.6	.9	2.6	1.8
4	.9	1.5	1.9	1.7	1.5	1.5	1.1	.6	.6	.9	2.7	1.8
5	.9	1.3	1.7	1.8	1.5	1.5	1.2	.6	.7	.9	2.6	1.8
6	.9	1.3	1.6	1.7	1.5	1.5	1.2	.6	.7	2.0	2.6	1.8
7	.9	1.3	1.5	1.8	1.5	1.5	1.2	.9	.8	2.5	2.6	1.9
8	.9	1.3	1.5	1.9	1.5	1.4	1.1	1.0	.6	2.9	2.6	1.9
9	.9	1.3	1.6	1.9	1.5	1.3	1.0	.9	.6	4.4	2.6	1.8
10	.9	1.3	1.5	1.9	1.5	1.3	1.0	.9	.7	3.6	2.5	1.9
11	.9	1.3	1.5	1.8	1.5	1.6	.8	.9	.7	3.3	2.5	1.9
12	.9	1.2	1.7	1.8	1.4	1.5	.7	.9	.6	3.8	2.5	2.4
13	.9	1.2	2.0	2.0	1.3	1.5	.7	1.0	.6	3.4	2.3	2.9
14	.9	1.6	2.0	2.0	1.3	1.5	.7	1.0	.6	2.7	2.3	3.0
15	.9	1.7	1.9	1.9	1.3	1.4	.7	1.0	.6	2.4	2.3	3.1
16	.9	1.8	1.8	1.8	1.3	1.4	.7	1.0	.8	3.8	2.4	3.1
17	.9	2.0	1.8	1.8	1.3	1.4	.6	1.1	.8	4.4	2.4	2.9
18	.9	2.1	2.0	1.9	1.3	1.4	.6	1.1	.8	4.6	2.4	2.8
19	.9	.....	1.9	1.9	1.2	1.4	.6	1.0	.8	5.0	2.3	2.7
20	.9	1.9	1.9	1.8	1.2	1.4	.6	1.0	.7	5.3	2.3	2.6
21	.9	1.9	1.9	1.9	1.2	1.4	.6	.8	.7	4.9	2.3	2.6
22	.9	1.8	1.9	1.9	1.2	1.3	.6	.8	.7	4.7	2.3	2.4
23	.9	1.7	1.9	1.8	1.2	1.3	.6	.9	.8	4.4	2.3	2.3
24	.9	2.3	1.7	1.8	1.5	1.3	.6	.8	.7	4.2	2.3	2.2
25	1.0	1.9	1.7	1.8	1.5	1.2	.6	.8	.8	4.0	2.1	2.1
26	1.0	1.9	1.7	1.8	1.4	1.2	.6	.8	.7	3.7	2.0	2.1
27	1.4	1.9	1.7	1.8	1.4	1.2	.6	.7	.9	3.6	2.0	2.2
28	1.4	1.7	1.9	1.7	1.5	1.1	.6	.7	.8	3.5	2.0	2.3
29	1.5	.....	1.9	1.6	1.5	1.0	.7	.6	.9	3.2	1.9	2.4
30	1.5	.....	1.9	1.6	1.5	1.0	.7	.6	.9	3.3	1.9	2.6
31	1.4	.....	1.9	.....	1.4	.....	.8	.5	.....	3.0	.....	.....

NOTE.—Ice present Jan. 1 to Feb. 28 and Dec. 1 to 31.

Daily discharge, in second-feet, of Minnesota River near Mankato, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	679	790	625	469	322	227	89	274	1,400
2	679	734	625	625	370	227	89	227	1,340
3	734	734	572	572	370	134	134	274	1,210
4	790	679	572	572	370	134	134	274	1,270
5	679	734	572	572	419	134	180	274	1,210
6	625	679	572	572	419	134	180	847	1,210
7	572	734	572	572	419	274	227	1,150	1,210
8	572	790	572	520	370	322	134	1,400	1,210
9	625	790	572	469	322	274	134	2,640	1,210
10	572	790	572	469	322	274	180	1,910	1,150
11	572	734	572	625	227	274	180	1,680	1,150
12	679	734	520	572	180	274	134	2,080	1,150
13	847	847	469	572	180	322	134	1,760	1,020
14	847	847	469	572	180	322	134	1,270	1,020
15	790	790	469	520	180	322	134	1,080	1,020
16	734	734	469	520	180	322	227	2,080	[a] 1,020
17	734	734	469	520	134	370	227	2,640	[a] 1,020
18	847	790	469	520	134	370	227	2,840	[a] 1,020
19	790	790	419	520	134	322	227	3,280	1,020
20	790	734	419	520	134	322	180	3,650	1,020
21	790	790	419	520	134	227	180	3,170	1,020
22	790	790	419	469	134	227	180	2,950	1,020
23	790	734	419	469	134	274	227	2,640	1,020
24	679	734	572	469	134	227	180	2,440	1,020
25	679	734	572	419	134	227	227	2,260	905
26	679	734	520	419	134	227	180	2,000	847
27	679	734	520	419	134	180	274	1,910	847
28	790	679	572	370	134	180	227	1,830	847
29	790	625	572	322	180	134	274	1,610	790
30	790	625	572	322	180	134	274	1,680	790
31	790	.....	520	.....	227	89	.....	1,470	.....

[a] Daily discharge estimated.

NOTE.—Daily discharge computed from a well-defined rating curve.

Monthly discharge of Minnesota River near Mankato, Minn., for 1911.

[Drainage area, 14,600 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	[a] 175	0.012	0.01	C.
February	.....	.....	[a] 190	.013	.01	C.
March	847	572	723	.050	.06	A.
April	847	625	746	.051	.06	A.
May	625	419	524	.036	.04	A.
June	625	322	502	.034	.04	A.
July	419	134	227	.016	.02	A.
August	370	89	241	.017	.02	A.
September	274	89	184	.013	.01	A.
October	3,650	227	1,790	.123	.14	A.
November	1,400	790	1,070	.073	.08	B.
December	.....	.....	[b] 740	.051	.06	C.
The year	3,650	.....	596	.041	.55	

[a] Estimated from two ice measurements, daily gage height, and climatologic records.
[b] Estimated from daily gage height and climatologic records.

WHETSTONE RIVER NEAR BIG STONE, S. DAK.

Location.—At the State Line bridge, one-fourth mile southeast of Big Stone and nearly a mile above the mouth.

Records available.—Gage heights and discharge measurements from September 18, 1909, to November 15, 1911. Records of United States Engineer Corps September 15, 1899, to May 14, 1904.

Drainage area.—441 square miles.

Gage.—Vertical staff.

Channel.—Somewhat shifting during flood stages.

Discharge measurements of Whetstone River near Big Stone, S. Dak., in 1909–1912.

Date.	Hydrographer.	Gage height.	Discharge.
1909.		*Feet.*	*Sec. feet.*
July 25[a]	G. A. Gray	3.8	14.2
Aug. 16[a]	C. J. Emerson	3.8	9.7
Sept. 18[a]	G. A. Gray	.65	5.0
1910.			
Mar. 15	.....do	4.66	399
Apr. 15	.....do	1.40	65.6
29[b]	Robert Follansbee	3.10	170
1911.			
May 6	C. J. Emerson	.7	5.9
1912.			
Apr. 10	S. B. Soulé	1.48	33.6
10	.....do	1.48	33.7
May 5	.....do	3.24	172
June 21[c]	W. G. Hoyt	1.20	19.4

[a] Published as miscellaneous in Water-Supply Paper 265.
[b] Made at iron bridge above Big Stone.
[c] Measurement made by wading about 100 feet above gage.

Daily gage height, in feet, of Whetstone River near Big Stone, S. Dak., for 1911.

[F. W. Thorndike, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	0.9	0.8	0.6	0.5	0.3	0.2	0.8	0.6
2	.....	.9	.8	.6	.5	.4	.2	.7	.6
3	.....	1.0	.7	.8	.5	.4	.2	.8	.6
4	.....	1.0	.7	1.55	.5	.55	.2	.8	.5
5	.....	1.0	.7	1.2	.85	.55	.4	.8	.5
6	.....	1.0	.7	1.7	.75	.5	.65	.95	.5
7	.....	.95	.7	1.2	.55	.6	.7	1.0	.5
8	.....	.9	.7	1.05	.5	.6	.55	1.0	.5
9	.....	.9	.7	.85	.5	.6	.5	1.0	.4
10	.....	1.0	.7	.75	.5	.6	.5	.9	.4
11	.....	1.0	.7	.7	.5	.5	.5	.9	.4
12	.....	1.1	.7	.7	.5	.6	.5	1.0	.....
13	.....	1.25	.7	.6	.5	.6	.5	1.0	.....
14	.....	1.45	.7	.6	.5	.7	.6	1.0	.....
15	.....	1.35	.75	.6	.4	.6	.6	1.0	.....
16	.....	1.15	.8	.6	.4	.5	.5	1.0	.....
17	.....	1.1	.8	.6	.35	.5	.4	1.0	.....
18	.....	1.1	.8	.6	.3	.5	.4	.9	.....
19	1.85	1.0	.7	.6	.4	.4	.4	.85	.....
20	1.65	1.0	.7	.5	.4	.4	.4	.8	.....
21	1.45	1.0	.7	.4	.35	.4	.4	.75	.....
22	1.4	.9	.7	.4	.4	.3	.4	.7	.....
23	1.25	.9	.7	.4	.4	.3	.5	.7	.....
24	1.15	.8	.7	.4	.4	.3	.5	.65	.....
25	1.1	.8	.7	.4	.3	.3	.5	.6	.....
26	1.1	.8	.7	.4	.3	.3	.4	.6	.....
27	1.05	.8	.7	.4	.3	.3	.4	.6	.....
28	1.0	.8	.6	.4	.3	.3	1.1	.6	.....
29	1.0	.8	.6	.6	.3	.2	.95	.6	.....
30	1.0	.....	.6	.55	.3	.2	.75	.6	.....
31	.9	.....	.6	.....	.3	.2	.....	.6	.....

NOTE.—Ice present from Jan. 1 to Mar. 18 and from Nov. 12 to Dec. 31.

Daily discharge, in second-feet, of Whetstone River near Big Stone, S. Dak., for 1910–11.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1910.									
1	.....	52	121	13	5.0	4.5	5.0	6.0	6.0
2	.....	46	106	13	4.5	4.5	5.0	6.0	6.0
3	.....	49	76	13	4.5	4.5	5.0	6.0	6.0
4	.....	49	64	10	4.5	4.5	5.0	5.5	8.0
5	.....	43	61	10	5.0	4.5	5.0	5.0	8.0
6	.....	37	55	10	5.0	4.5	5.0	5.0	8.0
7	.....	37	55	10	5.0	4.5	5.0	5.0	8.0
8	2,070	37	49	10	5.0	4.5	4.5	4.8	8.0
9	.....	37	49	16	5.0	4.5	4.5	4.5	9.0
10	.....	34	49	19	5.0	4.5	4.5	4.5	8.0
11	.....	30	43	19	5.0	4.5	4.5	4.5	14
12	.....	27	37	23	5.0	4.5	4.5	4.5	9.0
13	.....	25	37	23	5.0	5.0	4.5	4.5	9.0
14	.....	23	32	19	5.0	5.0	4.5	4.5	9.0
15	.....	25	27	16	5.0	5.0	4.5	4.5	8.0
16	248	34	27	13	5.0	6.0	4.5	4.5	13
17	206	34	27	10	5.0	6.0	4.5	4.8	9.0
18	174	27	27	10	4.5	6.0	4.5	5.0	8.0
19	158	30	27	8.0	4.5	6.0	4.5	8.0	12
20	152	34	23	6.0	4.5	6.0	4.5	10	8.0
21	141	102	23	6.0	4.5	6.0	4.5	10	14
22	131	1,300	23	5.0	4.5	6.0	4.5	10	9.0
23	116	1,030	23	5.0	4.5	6.0	4.5	8.0	10
24	102	447	19	4.5	4.5	6.0	4.5	8.0	12
25	88	308	19	4.5	4.5	5.0	4.8	8.0	8.0
26	80	255	19	7.0	4.5	5.0	7.0	8.0	9.0
27	68	227	18	10	4.5	5.0	8.0	8.0	10
28	61	192	16	7.0	4.5	5.0	8.0	6.0	10
29	58	163	16	6.0	4.5	5.0	8.0	6.0	10
30	61	136	16	5.5	4.5	5.0	8.0	6.0	10
31	55	.....	13	.....	4.5	5.0	.....	6.0	.....

Daily discharge, in second-feet, of Whetstone River near Big Stone, S. Dak., for 1910–11—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1911.									
1	.....	10	8.0	5.0	4.5	3.5	3.0	8.0	5.0
2	.....	10	8.0	5.0	4.5	4.0	3.0	6.0	5.0
3	.....	13	6.0	8.0	4.5	4.0	3.0	8.0	5.0
4	.....	13	6.0	34	4.5	4.8	3.0	8.0	4.5
5	.....	13	6.0	19	9.0	4.8	4.0	8.0	4.5
6	.....	13	6.0	43	7.0	4.5	5.5	12	4.5
7	.....	12	6.0	19	4.8	5.0	6.0	13	4.5
8	.....	10	6.0	14	4.5	5.0	4.8	13	4.5
9	.....	10	6.0	9.0	4.5	5.0	4.5	13	4.0
0	.....	13	6.0	7.0	4.5	5.0	4.5	10	4.0
1	.....	13	6.0	6.0	4.5	4.5	4.5	10	4.0
2	.....	16	6.0	6.0	4.5	5.0	4.5	13	.....
3	.....	21	6.0	5.0	4.5	5.0	4.5	13	.....
4	.....	30	6.0	5.0	4.5	6.0	5.0	13	.....
5	.....	25	7.0	5.0	4.0	5.0	5.0	13	.....
6	.....	18	8.0	5.0	4.0	4.5	4.5	13	.....
7	.....	16	8.0	5.0	3.8	4.5	4.0	13	.....
8	.....	16	8.0	5.0	3.5	4.5	4.0	10	.....
9	52	13	6.0	5.0	4.0	4.0	4.0	9.0	.....
0	40	13	6.0	4.5	4.0	4.0	4.0	8.0	.....
1	30	13	6.0	4.0	3.8	4.0	4.0	7.0	.....
2	27	10	6.0	4.0	4.0	3.5	4.0	6.0	.....
3	21	10	6.0	4.0	4.0	3.5	4.5	6.0	.....
4	18	8.0	6.0	4.0	4.0	3.5	4.5	5.5	.....
5	16	8.0	6.0	4.0	3.5	3.5	4.5	5.0	.....
6	16	8.0	6.0	4.0	3.5	3.5	4.0	5.0	.....
7	14	8.0	6.0	4.0	3.5	3.5	4.0	5.0	.....
8	13	8.0	5.0	4.0	3.5	3.5	16	5.0	.....
9	13	8.0	5.0	5.0	3.5	3.0	12	5.0	.....
0	13	8.0	5.0	4.8	3.5	3.0	7.0	5.0	.....
1	10	.....	5.0	.....	3.5	3.0	.....	5.0	.....

NOTE.—Daily discharge computed from a rating curve well defined between 5 and 467 second-feet (gage eights 0.6 and 5.0 feet). Outside of these limits the rating curve is an extension.

Monthly discharge of Whetstone River near Big Stone, S. Dak., for 1910–11.

[Drainage area, 441 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1910.						
larch 16–31	248	55	119	0.270	0.16	C.
pril	1,300	23	162	.367	.41	D.
lay	121	13	38.6	.088	.10	B.
une	23	4.5	11.0	.025	.03	B.
uly	5.0	4.5	4.73	.011	.01	C.
ugust	6.0	4.5	5.10	.012	.01	C.
eptember	8.0	4.5	5.18	.012	.01	C.
ctober	10	4.5	6.16	.014	.02	C.
lovember	14	6.0	9.20	.021	.02	C.
1911.						
larch 19–31	52	10	21.8	.049	.02	C.
pril	30	8.0	12.9	.029	.03	B.
lay	8.0	5.0	6.23	.014	.02	C.
une	43	4.0	8.54	.019	.02	C.
uly	9.0	3.5	4.32	.0098	.01	C.
ugust	6.0	3.0	4.20	.0095	.01	C.
eptember	16	3.0	4.99	.011	.01	C.
ctober	13	5.0	8.82	.020	.02	C.
ovember 1–11	5.0	4.0	4.50	.010	.004	C.

LAC QUI PARLE RIVER AT LAC QUI PARLE, MINN.

Location.—At the highway bridge at Lac qui Parle in sec. 26, T. 118 N., R. 42 W., in Lac qui Parle County, a short distance above the mouth of Threemile Creek.

Records available.—Gage heights and discharge measurements from April 27, 1910, to November 15, 1911.

Drainage area.—677 square miles.

Gage.—Vertical staff; datum unchanged since established.

Channel.—Probably permanent except during flood stages.

Discharge measurements.—Made from the bridge.

Winter flow.—The river is frozen over and observations are discontinued from December to March.

Regulation.—There are no dams on the stream which control its flow at the present time.

The following discharge measurement was made by C. J. Emerson:
May 6, 1911: Gage height, 1.08 feet; discharge 15.1 second-feet.

Daily gage height, in feet, of Lac qui Parle River at Lac qui Parle, Minn., for 1911.

[Chas. A. Gould, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.50	1.20	0.70	0.60	0.38	0.30	0.60	1.40
2	.....	1.60	1.15	.70	.65	.32	.28	.60	1.30
3	.....	1.50	1.12	.75	.60	.30	.25	.70	1.10
4	.....	1.40	1.12	.80	.52	.42	.28	.62	1.10
5	.....	1.40	1.10	.85	.50	.40	.25	.60	1.10
6	.....	1.30	1.10	.80	.50	.40	.30	.82	1.05
7	.....	1.30	1.05	.80	.45	.42	.60	1.02	1.10
8	.....	1.45	1.00	.80	.42	.42	.60	1.00	1.10
9	1.20	1.50	1.00	.80	.42	.48	.61	1.05	1.20
10	2.40	1.45	1.00	.72	.42	.48	.60	1.10	1.20
11	3.20	1.45	.95	.70	.40	.48	.60	1.20	1.15
12	4.50	1.50	.90	.60	.40	.48	.61	1.22	.....
13	4.00	1.70	.90	.60	.38	.45	.70	1.38	.....
14	3.85	1.90	.95	.58	.35	.45	.70	1.35	.....
15	3.45	1.90	.85	.55	.32	.42	.60	1.50	.....
16	2.15	1.95	.85	.70	.30	.40	.55	1.60	.....
17	2.05	1.90	.88	.62	.28	.40	.52	1.70	.....
18	1.90	1.80	.85	.60	.22	.40	.50	1.60	.....
19	1.40	1.65	.88	.55	.32	.45	.50	1.52	.....
20	2.00	1.55	.85	.55	.32	.50	.50	1.52	.....
21	2.10	1.45	.90	.50	.30	.45	.50	1.58	.....
22	1.85	1.40	.92	.50	.45	.42	.50	1.55	.....
23	1.80	1.40	.92	.45	.50	.40	.50	1.60	.....
24	1.70	1.30	.90	.42	.45	.38	.55	1.60	.....
25	1.65	1.30	.88	.42	.42	.38	.60	1.55	.....
26	1.65	1.25	.85	.45	.40	.35	.55	1.50	.....
27	1.20	1.30	.82	.45	.40	.40	.42	1.45	.....
28	1.60	1.25	.80	.40	.38	.35	.50	1.40	.....
29	1.30	1.25	.78	.52	.35	.32	.50	1.35	.....
30	1.30	1.20	.75	.65	.35	.32	.50	1.30	.....
31	1.40	.....	.72	.....	.40	.30	.....	1.30	.....

NOTE.—Ice present from Jan. 1 to Mar. 8 and Nov. 12 to Dec. 31.

Daily discharge, in second-feet, of Lac qui Parle River at Lac qui Parle, Minn., for 1910–1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1910.								
1	.....	161	32	28	5	5	8	9
2	.....	147	30	23	5	5	8	9
3	.....	134	28	21	7	5	9	9
4	.....	121	28	19	6	5	9	12
5	.....	109	28	17	7	5	8	12
6	.....	102	29	43	6	5	7	16
7	.....	97	30	21	5	5	7	12
8	.....	95	30	19	5	5	7	10
9	.....	89	36	17	5	5	7	9
10	.....	85	48	17	5	5	7	7
11	.....	79	70	15	5	5	6	10
12	.....	75	147	19	4	4	6	12
13	.....	70	161	19	5	5	6	9
14	.....	66	134	19	5	4	6	10
15	.....	62	105	17	7	5	6	9
16	.....	62	85	17	8	5	6	.....
17	.....	66	66	15	18	5	6	.....
18	.....	66	52	14	14	5	6	.....
19	.....	66	42	11	10	5	9	.....
20	.....	75	36	10	9	5	7	.....
21	.....	68	34	9	10	5	7	.....
22	.....	64	28	8	12	5	7	.....
23	.....	62	25	8	9	5	8	.....
24	.....	56	23	7	10	5	9	.....
25	.....	52	21	7	9	5	9	.....
26	.....	48	21	6	8	7	9	.....
27	276	46	21	6	7	7	9	.....
28	254	42	21	7	7	7	9	.....
29	223	40	25	6	6	8	9	.....
30	200	35	28	6	7	8	9	.....
31	.....	34	.....	6	6	.....	9	.....

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1911.									
1	.....	35	20	5	4	3	2	4	29
2	.....	41	18	5	4	2	2	4	24
3	.....	35	17	6	4	2	2	5	16
4	.....	29	17	7	3	3	2	4	16
5	.....	29	16	8	3	3	2	4	16
6	.....	24	16	7	3	3	2	7	14
7	.....	24	14	7	3	3	4	13	16
8	.....	32	12	7	3	3	4	12	16
9	20	35	12	7	3	3	4	14	20
10	107	32	12	5	3	3	4	16	20
11	220	32	10	5	3	3	4	20	18
12	500	35	9	4	3	3	4	21	.....
13	375	47	9	4	3	3	5	28	.....
14	340	60	10	4	2	3	5	26	.....
15	263	60	8	4	2	3	4	35	.....
16	82	64	8	5	2	3	4	41	.....
17	72	60	9	4	2	3	3	47	.....
18	60	53	8	4	1	3	3	41	.....
19	29	44	9	4	2	3	3	36	.....
20	68	38	8	4	2	3	3	36	.....
21	77	32	9	3	2	3	3	40	.....
22	56	29	10	3	3	3	3	38	.....
23	53	29	10	3	3	3	3	41	.....
24	47	24	9	3	3	3	4	41	.....
25	44	24	9	3	3	3	4	38	.....
26	44	22	8	3	3	3	4	35	.....
27	20	24	7	3	3	3	3	32	.....
28	41	22	7	3	3	3	3	29	.....
29	24	22	7	3	2	2	3	26	.....
30	24	20	6	4	2	2	3	24	.....
31	29	.....	6	.....	3	2	.....	24	.....

NOTE.—Daily discharge computed from a rating curve fairly well defined between discharges 12 and 375 second-feet (gage heights 1.0 and 4.0 feet). In making the computations the rating table was used to whole second-feet only.

Monthly discharge of Lac qui Parle River at Lac qui Parle, Minn., for 1910-1911.

[Drainage area, 838 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1910.						
May	161	34	76.6	0.091	0.10	B.
June	161	21	48.8	.058	.06	B.
July	43	6	14.7	.018	.02	C.
August	18	4	7.5	.0090	.01	D.
September	8	4	5.3	.0063	.007	D.
October	9	6	7.6	.0091	.01	D.
November 1-15	16	7	10.3	.012	.007	D.
1911.						
March 9-31	500	20	113	0.135	0.12	C.
April	64	20	35.2	.042	.05	B.
May	20	6	10.6	.013	.02	C.
June	8	3	4.6	.0055	.006	D.
July	4	1	2.7	.0032	.004	D.
August	3	2	2.8	.0033	.004	D.
September	5	2	3.3	.0039	.004	D.
October	47	4	25.2	.030	.03	C.
November 1-11	29	14	18.6	.022	.009	C.

CHIPPEWA RIVER NEAR WATSON, MINN.

Location.—At highway bridge 2½ miles northeast of Watson, on line between secs. 10 and 15, T. 118 N., R. 41 W., 10 miles above the mouth of the river and about 2 miles below the mouth of Dry Weather Creek.

Records available.—July 6, 1909, to November 10, 1911.

Drainage area.—1,940 square miles.

Gage.—Chain gage attached to bridge; datum unchanged since established.

Channel.—Somewhat shifting.

Discharge measurements.—Made from the bridge.

Regulation.—At Montevideo there is a water-power plant utilizing a head of 7 feet, but backwater from the dam does not extend to the gaging station. The first dam above the station is at Hagan, but the effect of the control is inappreciable at Watson.

Winter flow.—From January 1 to March 18, 1911, observations were discontinued because of ice.

Accuracy.—As the discharge measurements show some change in the channel, the records can not be considered better than good.

Discharge measurement of Chippewa River near Watson, Minn., 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 6	C. J. Emerson	4.66	47.0
June 23[a]	S. B. Soulé	4.99	77.9
Aug. 4[a]	do	4.17	13.7
Dec. 8[b]	C. J. Emerson	5.28	28

[a] Measurement made by wading.
[b] Measurement made under complete ice cover. Average thickness of ice, 0.64 foot. Average distance water surface to top of ice, 0.10 foot.

Daily gage height, in feet, of Chippewa River near Watson, Minn., for 1911.

[Clifford Bonde, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.78	4.88	4.38	4.70	4.10	4.30	4.60	.....	5.25
2	.....	.....	4.81	4.42	4.68	4.02	4.40	4.68	5.68	.....
3	.....	4.71	4.76	4.99	4.68	3.98	4.30	4.72	5.55	.....
4	.....	4.84	4.76	6.02	4.60	4.17	4.35	.....	5.60	5.25
5	.....	4.84	4.74	5.45	4.58	4.25	4.40	4.78	5.50	.....
6	.....	4.81	4.66	5.55	4.50	4.24	4.40	4.90	5.42	.....
7	.....	4.86	.....	5.60	4.48	4.30	4.50	4.90	5.40	.....
8	.....	4.81	4.72	5.60	4.42	4.32	4.50	.....	5.35	5.28
9	.....	4.81	4.68	5.52	4.48	4.32	4.45	4.92	5.35	.....
10	.....	4.84	4.65	5.50	4.50	4.32	4.50	4.80	5.20	.....
11	.....	4.98	4.52	5.60	.....	4.32	4.50	4.90	5.10	5.32
12	.....	.....	4.58	5.40	4.42	4.35	4.55	4.88	.....	.....
13	.....	5.06	4.50	5.35	4.40	4.32	4.58	4.95	5.45	.....
14	.....	5.21	.....	5.30	4.32	4.30	4.58	4.95	.....	5.30
15	.....	5.16	4.50	5.30	4.28	.....	4.55	4.95	.....	.....
16	.....	5.21	4.58	5.35	4.22	4.25	4.58	5.08	5.30	.....
17	.....	5.21	4.58	5.45	4.20	4.25	4.52	5.12	.....	.....
18	.....	5.21	4.78	5.40	4.15	4.25	4.55	5.10	.....	5.22
19	5.11	5.14	4.82	5.50	4.20	4.25	4.52	5.18	.....	.....
20	.....	5.06	5.05	5.45	4.20	.....	4.52	5.20	5.22	.....
21	.....	5.06	4.95	5.35	4.18	4.20	.....	5.22	.....	5.20
22	5.21	4.96	4.90	5.15	4.15	4.25	4.55	.....	.....	.....
23	5.26	.....	4.82	5.02	4.12	4.25	4.52	5.30	5.30	.....
24	.....	4.96	4.80	5.00	4.10	4.25	4.52	5.30	.....	.....
25	5.18	4.86	4.70	4.88	4.08	4.25	4.52	5.35	.....	.....
26	.....	4.86	4.70	4.88	4.05	4.20	4.40	5.40	.....	5.35
27	4.66	4.86	4.58	4.80	4.02	.....	4.48	5.42	5.30	.....
28	5.18	4.84	4.52	4.75	4.00	4.45	4.48	5.45	.....	5.35
29	4.96	4.86	4.45	4.98	3.98	4.32	4.55	5.50	.....	.....
30	5.06	4.86	4.42	4.80	3.95	4.35	4.52	5.50	.....	.....
31	4.96	.....	4.38	.....	4.05	4.32	.....	.....	.....	.....

NOTE.—Relation of gage height to discharge affected by ice Nov. 11 to Dec. 31.

Daily discharge, in second-feet, of Chippewa River near Watson, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	58	67	27	51	10	21	43	150
2	.....	55	61	29	49	7.6	28	49	168
3	.....	52	56	78	49	6.6	21	53	148
4	.....	64	56	228	43	14	24	55	155
5	.....	64	55	133	41	18	28	58	140
6	.....	61	48	148	35	17	28	69	129
7	.....	65	50	155	34	21	35	69	126
8	.....	61	53	155	29	22	35	70	120
9	.....	61	49	143	34	22	32	71	120
10	.....	64	47	140	35	22	35	60	101
11	.....	77	37	155	32	22	35	69	.....
12	.....	82	41	126	29	24	39	67	.....
13	.....	86	35	120	28	22	41	74	.....
14	.....	102	35	113	22	21	41	74	.....
15	.....	97	35	113	20	20	39	74	.....
16	.....	102	41	120	16	18	41	88	.....
17	.....	102	41	133	15	18	37	92	.....
18	.....	102	58	126	12	18	39	90	.....
19	91	94	62	140	15	18	37	99	.....
20	94	86	84	133	15	16	37	101	.....
21	97	86	74	120	14	15	38	103	.....
22	102	75	69	96	12	18	39	108	.....
23	108	75	62	81	11	18	37	113	.....
24	104	75	60	79	10	18	37	113	.....
25	99	65	51	67	9.4	18	37	120	.....
26	73	65	51	67	8.5	15	28	126	.....
27	48	65	41	60	7.6	24	34	129	.....
28	99	64	37	56	7	32	34	133	.....
29	75	65	32	77	6.6	22	39	140	.....
30	86	65	29	60	6	24	37	140	.....
31	75	.....	27	.....	8.5	22	.....	140	.....

NOTE.—Daily discharge computed from fairly well defined rating curve. Discharge estimated for days of missing gage heights. Discharge Nov. 11 to Dec. 31 estimated because of ice, from one discharge measurement, gage observer's notes, and climatologic records. Mean discharge Nov. 11 to 30 estimated 42 second-feet, varying from about 25 to 80 second-feet. Mean discharge Dec. 1 to 31 estimated 28 second-feet, varying from about 15 to 35 second-feet.

Monthly discharge of Chippewa River near Watson, Minn., in 1911.

[Drainage area, 1,940 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
Mar. 19-31	108	48	88.5	0.046	0.02	B.
April	102	52	74.5	.038	.04	A.
May	84	27	49.8	.026	.03	A.
June	228	27	109	.056	.06	A.
July	51	6	22.7	.012	.01	B.
August	32	6.6	18.8	.0097	.01	B.
September	41	21	34.4	.018	.02	A.
October	140	43	90.0	.046	.05	B.
November	168	.....	73.2	.038	.04	C.
December	.....	.....	28.0	.014	.02	D.

NOTE.—See footnotes to table of daily discharge.

REDWOOD RIVER NEAR REDWOOD FALLS, MINN.

Location.—At the first highway bridge above Redwood Falls, 3 miles distant.

Records available.—July 2, 1909, to November 15, 1911.

Drainage area.—703 square miles.

Gage.—Chain gage attached to bridge; datum unchanged since established.

Channel.—Practically permanent, the flow being controlled by slight rapids just below the bridge.

Discharge measurements.—Made from the bridge except at low stages when they are made by wading at different sections.

Winter flow.—Ice exists from December to March, discharge measurements are made to determine the winter flow.

Regulation.—The nearest dam, that at Redwood Falls, creates a pond extending upstream for a considerable distance, but owing to rapids just below the gaging station the backwater does not reach it.

Discharge measurements of Redwood River near Redwood Falls, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
May 4	C. J. Emerson	1.88	[a] 15.0
June 22	S. B. Soulé	1.68	[b] 5.2
Dec. 6	C. J. Emerson	1.94	[c] 12.0

[a] Discharge estimated.
[b] Measurement made by wading.
[c] Measurement made under complete ice cover. Average thickness of ice 0.07 foot. Average distance, water surface to top of ice 0.09 foot.

Daily gage height, in feet, of Redwood River near Redwood Falls, Minn., for 1911.

[Floyd Reynolds, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.05	1.93	1.82	1.60	1.55	1.70	1.90	.....	.....
2	.....	2.07	1.90	1.80	1.58	1.55	1.70	1.88	.....	.....
3	.....	1.95	1.86	1.75	1.58	1.60	1.70	1.88	.....	.....
4	.....	2.00	1.88	1.70	.....	1.60	1.72	1.88	.....	.....
5	.....	2.05	1.88	1.65	1.58	1.78	.....	1.88	.....	.....
6	.....	2.03	1.90	1.65	1.55	1.75	.....	2.62	.....	1.94
7	.....	2.00	1.90	1.68	1.55	1.72	.....	2.22	.....	.....
8	.....	2.05	1.90	1.70	1.55	1.70	.....	2.00	.....	.....
9	.....	2.03	1.90	1.72	.....	1.65	.....	2.10	.....	.....
10	.....	2.03	1.90	1.72	.....	1.60	.....	2.05	.....	.....
11	.....	2.05	1.88	.....	.....	1.75	.....	2.20	.....	.....
12	2.65	2.15	1.88	.....	.....	1.70	.....	2.40	.....	.....
13	2.63	2.20	1.85	.....	.....	1.65	.....	2.28	.....	.....
14	2.60	2.15	1.85	.....	.....	1.60	.....	2.20	.....	.....
15	2.60	2.10	1.85	.....	.....	1.60	.....	2.22	.....	.....
16	2.45	2.10	1.88	.....	1.55	1.58	.....	2.20	.....	.....
17	2.35	2.10	1.85	.....	1.55	1.70	1.80	2.25	.....	.....
18	2.20	2.05	1.85	.....	1.55	1.72	1.80	2.20	.....	.....
19	2.05	2.05	1.82	.....	1.52	1.75	1.80	2.30	.....	.....
20	.....	2.03	1.80	1.72	1.52	1.80	1.75	2.22	.....	.....
21	.....	2.00	1.88	1.70	1.52	1.78	1.80	2.30	.....	.....
22	.....	1.97	1.90	1.68	1.52	1.78	1.78	2.28	.....	.....
23	.....	1.95	1.90	1.65	1.64	1.80	1.75	2.22	.....	.....
24	2.13	1.95	1.88	1.65	1.62	1.80	1.72	2.22	.....	.....
25	2.10	1.95	1.88	1.64	1.60	1.75	1.70	2.20	.....	.....
26	2.10	1.93	1.85	1.65	1.58	1.78	1.75	2.15	.....	.....
27	2.05	1.93	1.85	1.62	1.81	1.75	1.78	2.10	.....	.....
28	2.00	1.90	1.82	1.60	1.65	1.75	.....	2.10	.....	.....
29	2.00	1.90	1.82	1.62	1.58	1.72	.....	2.12	.....	.....
30	2.03	1.95	1.82	1.65	1.56	1.70	.....	2.10	.....	.....
31	2.05	.....	1.82	.....	1.65	1.68	.....	2.10	.....	.....

NOTE.—Ice present Jan. 1 to Mar. 11 and about Nov. 12 to Dec. 31. Gage not read by observer after Oct. 31. See list of discharge measurements.

Daily discharge, in second-feet, of Redwood River near Redwood Falls, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	28	17	10	2	1	5	15
2	.....	31	15	9	1.6	1	5	14
3	.....	19	13	7	1.6	2	5	14
4	.....	23	14	5	1.6	2	5.8	14
5	.....	28	14	3.5	1.6	8.2	6	14
6	.....	26	15	3.5	1	7	7	150
7	.....	23	15	4.4	1	5.8	7	54
8	.....	28	15	5	1	5	8	23
9	.....	26	15	5.8	1	3.5	9	34
10	.....	26	15	5.8	1	2	10	28
11	.....	28	14	5.8	1	7	11	50
12	158	42	14	5.8	1	5	12	92
13	153	50	12	5.8	1	3.5	11	65
14	144	42	12	5.8	1	2	10	50
15	144	34	12	5.8	1	2	10	54
16	104	34	14	5.8	1	1.6	9	50
17	80	34	12	5.8	1	5	9	60
18	50	28	12	5.8	1	5.8	9	50
19	28	28	10	5.8	.4	7	9	69
20	30	26	9	5.8	.4	9	7	54
21	32	23	14	5	.4	8.2	9	69
22	34	21	15	4.4	.4	8.2	8.2	65
23	36	19	15	3.5	3.2	9	7	54
24	39	19	14	3.5	2.6	9	5.8	54
25	34	19	14	3.2	2	7	5	50
26	34	17	12	3.5	1.6	8.2	7	42
27	28	17	12	2.6	9.6	7	8.2	34
28	23	15	10	2	3.5	7	8	34
29	23	15	10	2.6	1.6	5.8	8	37
30	26	19	10	3.5	1.2	5	8	34
31	28	.....	10	.....	3.5	4.4	.....	34

NOTE.—Daily discharge computed from a well-defined rating curve. Discharge estimated for days of missing gage heights. Discharge estimated Nov. 1 to 11 because gage was not read. Discharge estimated Nov. 12 to Dec. 31 because of ice. Estimates for November (mean 17 second-feet) and December (mean 15 second-feet) are approximate and are based on one discharge measurement, climatologic records, and discharge of adjacent drainage areas.

Monthly discharge of Redwood River near Redwood Falls, Minn., for 1911.

[Drainage area, 703 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
March 12-31	158	23	61.4	0.087	0.06	B.
April	50	15	26.3	.037	.04	B.
May	17	9	13.1	.019	.02	B.
June	10	2	5.03	.0072	.008	C.
July	9.6	.4	1.67	.0024	.003	C.
August	9	1	5.30	.0075	.009	C.
September	12	5	7.97	.011	.01	B.
October	150	14	47.1	.067	.08	B.
November	.....	.....	[a] 17	.024	.03	
December	.....	.....	[a] 15	.021	.02	

[a] Estimated; very approximate.

NOTE.—See footnotes to table of daily discharge.

COTTONWOOD RIVER NEAR NEW ULM, MINN.

Location.—At Alwin highway bridge, 2 miles southeast of New Ulm, in sec. 31, T. 110 N., R. 30 W., 15 miles below the mouth of Sleepy Eye Creek, the nearest tributary.

Records available.—July 2, 1909, to December 31, 1911.

Drainage area.—1,190 square miles.

Gage.—Chain gage attached to bridge. On August 12, 1909, the datum of the gage was lowered 2.28 feet. All readings prior to that date have been corrected, so that all gage heights apply to the new datum.

Channel.—Slightly shifting, as shown by low-water measurements.

Discharge measurements.—Made from the bridge, except during extreme low water, when they are made at a wading section.

Winter flow.—Ice exists from December to March. No record of flow January 1 to March 11. Discharge measurement made and observations continued in December.

Regulation.—Two miles below the station is the dam of the Cottonwood roller mill, which prevents any possible effect of backwater from the Minnesota reaching the gage. The low-water records show no systematic variation to indicate control from the dam, and it is therefore believed that the effect of such control is slight.

Discharge measurements of Cottonwood River near New Ulm, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
May 2	C. J. Emerson	1.58	42.7
Aug. 3 [a]	S. B. Soulé	1.06	6.1
3 [a]	.....do	1.06	6.3
Dec. 5 [b]	C. J. Emerson	2.27	41

[a] Wading measurement 20 feet above bridge.
[b] Complete in cover; average thickness of ice 0.66 foot; average distance water surface to top of ice 0.06 foot.

Daily gage height, in feet, of Cottonwood River near New Ulm, Minn., for 1911.

[Esther Alvin, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.70	1.62	1.16	1.04	1.13	1.21	1.42	2.25	.....
2	.....	1.74	1.62	1.44	1.03	1.09	1.20	1.42	2.20	.....
3	.....	1.78	1.60	1.30	1.03	1.04	1.18	1.45	2.18	.....
4	.....	1.75	1.60	1.28	1.06	1.05	1.16	1.48	2.16	.....
5	.....	1.78	1.60	1.24	1.06	1.09	1.19	1.54	2.11	2.27
6	.....	1.80	1.55	1.18	1.03	1.16	1.22	1.82	2.09	.....
7	.....	1.76	1.50	1.18	1.01	1.28	1.26	2.09	2.04	1.25
8	.....	1.75	1.45	1.15	1.00	1.45	1.28	3.38	2.01	.....
9	.....	1.75	1.45	1.12	1.00	1.43	1.28	4.02	2.00	.....
10	.....	1.80	1.44	1.12	1.00	1.41	1.28	3.69	1.98	.....
11	.....	1.82	1.41	1.11	.99	1.40	1.26	3.28	1.92	1.95
12	3.28	1.82	1.40	1.10	.98	1.38	1.25	3.20	.....	.....
13	3.09	1.85	1.35	1.08	.96	1.38	1.25	3.20	.....	.....
14	2.86	1.88	1.40	1.08	.96	1.45	1.22	3.18	.....	2.1
15	2.72	1.89	1.40	1.06	.96	1.42	1.22	3.22	.....	.....
16	2.46	1.90	1.45	1.05	.95	1.41	1.20	3.51	.....	.....
17	2.29	1.90	1.49	1.08	.95	1.44	1.20	3.69	.....	.....
18	2.14	1.88	1.35	1.08	.98	1.46	1.20	3.71	.....	2.42
19	2.01	1.85	1.32	1.06	1.00	1.50	1.25	3.65	.....	.....
20	1.94	1.80	1.32	1.04	1.00	1.50	1.26	3.58	.....	.....
21	1.90	1.76	1.36	1.00	1.00	1.48	1.28	3.50	.....	2.45
22	1.90	1.68	1.40	1.00	1.00	1.44	1.32	3.30	.....	.....
23	1.88	1.69	1.38	1.00	1.00	1.41	1.35	3.02	.....	.....
24	1.86	1.70	1.35	1.00	.....	1.40	1.40	2.81	.....	.....
25	1.85	1.68	1.32	1.00	.....	1.38	1.40	2.69	.....	2.4
26	1.82	1.68	1.30	1.04	.....	1.36	1.40	2.46	.....	.....
27	1.79	1.65	1.28	.99	.....	1.35	1.40	2.38	.....	.....
28	1.76	1.65	1.25	.98	.....	1.35	1.40	2.36	.....	2.35
29	1.75	1.65	1.22	1.05	.....	1.35	1.42	2.35	.....	.....
30	1.75	1.62	1.20	1.05	.....	1.31	1.42	2.31	.....	.....
31	1.71	.....	1.19	.....	1.15	1.26	.....	2.30	.....	.....

NOTE.—Ice present Jan. 1 to Mar. 11 and Nov. 11 to Dec. 31.

Daily discharge, in second-feet, of Cottonwood River near New Ulm, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	49	42	11	5.6	9.5	14	26	116
2	.....	53	42	28	5.2	7.6	13	26	109
3	.....	57	40	19	5.2	5.6	12	28	106
4	.....	54	40	18	6.4	6	11	31	103
5	.....	57	40	15	6.4	7.6	12	35	96
6	.....	59	36	12	5.2	11	14	61	94
7	.....	55	32	12	4.4	18	17	94	87
8	.....	54	28	10	4	28	18	414	83
9	.....	54	28	9	4	27	18	679	82
10	.....	59	28	9	4	26	18	537	80
11	.....	61	26	8.5	3.7	25	17	377	72
12	377	61	25	8	3.4	24	16	349	.....
13	313	64	22	7.2	2.8	24	16	349	.....
14	245	68	25	7.2	2.8	28	14	342	.....
15	209	69	25	6.4	2.8	26	14	356	.....
16	152	70	28	6.0	2.5	26	13	464	.....
17	122	70	31	7.2	2.5	28	13	537	.....
18	101	68	22	7.2	3.4	29	13	545	.....
19	83	64	20	6.4	4	32	16	520	.....
20	75	59	20	5.6	4	32	17	492	.....
21	70	55	23	4	4	31	18	460	.....
22	70	47	25	4	4	28	20	384	.....
23	68	48	24	4	4	26	22	291	.....
24	66	49	22	4	4	25	25	232	.....
25	64	47	20	4	5	24	25	202	.....
26	61	47	19	5.6	6	23	25	152	.....
27	58	44	18	3.7	7	22	25	138	.....
28	55	44	16	3.4	8	22	25	134	.....
29	54	44	14	6	9	22	26	132	.....
30	54	42	13	6	10	20	26	126	.....
31	50	.....	12	.....	10	17	.....	124	.....

NOTE.—Daily discharge computed from a well-defined rating curve. Discharge estimated for days of missing gage heights. Discharge Nov. 12 to Dec. 31 estimated, because of ice, from one discharge measurement, gage observer's notes, and climatologic records. Mean discharge Nov. 12 to 30 estimated 42 second-feet, varying from about 35 to 60 second-feet. Mean discharge Dec. 1 to 31 estimated 55 second-feet, varying from about 35 to 80 second-feet.

Monthly discharge of Cottonwood River near New Ulm, Minn., for 1911.

[Drainage area, 1,190 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
March 12-31	377	50	117	0.098	0.07	B.
April	70	42	55.7	.047	.05	A.
May	42	12	26.0	.022	.03	A.
June	28	3.4	8.58	.0072	.008	B.
July	10	2.5	4.94	.0042	.005	B.
August	32	5.6	21.9	.018	.02	A.
September	26	11	17.8	.015	.02	B.
October	679	26	279	.234	.27	C.
November	116	.....	60.9	.051	.06	D.
December	.....	.....	55.0	.046	.05	D.

NOTE.—See footnotes to table of daily discharge.

ST. CROIX RIVER BASIN.

ST. CROIX RIVER NEAR ST. CROIX FALLS, WIS.

Location.—At the power plant of the Minneapolis General Electric Co., on the Wisconsin side of St. Croix River near St. Croix Falls, Wis., about 50 miles above the confluence of St. Croix and Mississippi rivers near Hastings, Minn. Apple River, draining an area wholly in Wisconsin, enters from the left about 2 miles below the station. Snake River enters from the right, about 35 miles above the station.

Records available.—1903 (published in Water-Supply Paper 98, pp. 176-177, under "St. Croix River near Taylors Falls, Minn."); January 10, 1902, to June 30, 1905 (published in the "Report of water-resources investigations of Minnesota during 1909-1910" by the Minnesota State Drainage Commission); January 1, 1910, to December 31, 1911.

Drainage area.—5,930 square miles.

Discharge.—The determinations of discharge are based on the kilowatt output of dynamo and exciters plus the flow over the dam and spillway, using them as a weir.

Cooperation.—Record kept and furnished for publication by the Minneapolis General Electric Co.

Accuracy.—Records have not been checked by engineers of the United States Geological Survey, but it is believed that they are reliable.

Daily discharge, in second-feet, of St. Croix River near St. Croix Falls, Wis., for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	3,218	3,035	3,820	5,588	2,652	3,174	1,684	1,446	1,701	1,396	1,385	1,953
2	3,470	2,925	4,035	5,455	2,413	2,165	1,112	1,451	1,701	728	1,390	1,440
3	3,204	2,790	3,825	5,170	3,878	2,044	610	1,400	1,821	1,569	1,405	1,048
4	3,164	3,565	4,255	5,588	3,478	1,923	1,122	1,398	606	1,579	1,458	648
5	2,495	3,351	3,030	5,158	2,660	2,610	1,635	1,496	1,172	1,585	1,668	1,190
6	2,710	3,725	2,952	5,118	2,893	2,584	1,425	1,258	1,699	1,583	725	1,238
7	2,946	2,825	2,875	4,744	2,656	1,903	1,555	452	1,674	1,611	1,694	1,403
8	3,220	2,795	2,940	4,779	2,335	1,928	1,685	1,353	1,773	1,951	1,543	1,725
9	3,495	3,511	2,965	2,158	2,045	2,354	1,227	1,700	1,644	602	1,549	1,741
10	2,905	2,801	3,015	2,650	5,457	2,439	500	1,501	1,591	1,638	1,502	1,743
11	2,856	2,801	3,210	4,103	1,873	1,933	1,804	1,466	680	1,766	1,557	629
12	2,797	2,960	4,563	3,093	1,407	1,760	1,363	1,399	1,736	1,777	1,508	1,417
13	3,065	3,725	5,125	3,127	4,658	1,929	1,799	1,290	1,733	1,770	671	1,343
14	2,880	2,850	5,800	3,162	5,202	1,936	1,790	393	1,411	1,738	1,291	1,139
15	2,940	2,650	6,845	3,043	1,950	1,899	1,668	1,398	1,234	1,732	1,449	1,311
16	3,725	2,810	7,240	3,163	1,835	1,937	1,268	1,554	1,383	629	1,500	1,473
17	3,020	2,620	8,018	3,725	1,510	2,227	75	1,359	1,519	1,643	1,214	1,535
18	2,960	2,900	9,393	2,949	1,185	1,398	1,838	1,412	666	1,513	997	638
19	2,561	3,212	8,959	4,278	2,043	550	1,799	1,404	1,317	1,700	1,348	1,270
20	2,921	3,525	8,525	3,113	3,325	1,822	1,774	1,320	1,446	1,725	728	1,408
21	2,770	2,458	9,871	3,079	2,057	1,853	1,815	452	1,456	1,750	1,607	1,266
22	2,850	2,545	8,010	4,625	790	1,737	1,723	1,475	1,453	1,780	1,526	1,245
23	3,725	2,876	8,203	3,923	2,330	1,622	1,297	1,637	1,221	635	1,727	1,219
24	3,080	2,715	8,238	3,675	2,628	1,672	343	1,633	1,098	1,663	691	1,518
25	3,030	2,510	8,234	4,958	3,033	1,113	1,408	1,597	759	1,776	1,362	842
26	2,821	3,520	7,911	5,159	3,553	555	1,482	1,567	1,407	1,826	1,600	850
27	3,095	4,150	7,675	4,307	4,633	1,734	1,493	1,564	1,639	1,662	674	1,106
28	2,605	4,045	6,695	1,957	4,455	2,208	1,488	521	1,659	1,699	1,474	1,296
29	3,050	.....	6,021	3,282	2,950	1,454	1,494	1,531	1,666	1,743	1,513	1,261
30	3,950	.....	6,274	2,892	2,315	1,569	1,495	1,538	1,614	634	1,518	1,306
31	2,945	.....	6,528	.....	1,493	.....	358	1,687	.....	1,578	.....	1,714
1911.												
1	653	1,580	1,508	2,816	2,580	4,456	2,160	2,030	1,505	1,597	2,669	2,000
2	935	1,429	1,543	3,161	2,662	3,633	1,111	1,870	1,466	2,582	2,474	2,213
3	1,693	1,372	1,563	2,744	2,280	3,020	1,573	2,012	1,012	2,448	2,464	1,104
4	1,413	1,616	1,574	1,851	2,181	2,327	1,188	2,032	1,552	2,450	2,431	2,256
5	1,333	1,068	819	2,065	2,180	3,362	1,970	1,824	1,725	2,480	1,213	2,173
6	807	1,556	1,458	2,473	2,440	5,241	1,845	1,011	1,576	2,871	2,216	2,165
7	1,484	1,576	1,522	2,511	962	4,771	1,620	1,887	1,577	3,250	2,486	2,208
8	719	1,591	1,557	2,494	2,099	5,207	1,623	2,133	1,699	4,106	2,462	2,247
9	1,336	1,493	1,527	2,593	2,216	5,026	1,104	2,115	1,706	4,255	2,536	2,198
10	1,301	1,457	1,476	2,625	2,164	3,960	2,134	2,084	1,022	4,914	2,463	1,149
11	1,293	1,571	1,567	2,120	2,198	5,870	2,186	2,046	1,726	3,895	2,554	2,073
12	1,116	938	1,796	2,126	2,144	3,972	2,170	2,046	1,640	3,368	1,338	2,122
13	1,130	1,597	2,243	2,840	2,234	3,014	2,109	1,158	1,798	3,143	2,426	2,200
14	1,053	1,506	2,427	4,313	4,259	3,794	2,117	1,958	1,766	3,351	1,905	2,228
15	557	1,357	2,640	4,369	4,616	3,143	2,102	2,095	2,712	4,350	1,894	2,193
16	1,200	1,343	2,168	4,346	3,763	2,960	928	1,992	3,065	4,593	1,710	2,224
17	1,109	1,268	2,394	4,373	3,330	2,702	3,468	2,148	3,214	5,010	1,994	1,063
18	1,112	1,593	2,761	3,887	4,251	1,877	2,097	2,100	2,760	5,184	1,883	2,165
19	1,077	808	2,753	3,574	5,995	2,981	1,734	2,072	4,422	4,901	1,101	2,204
20	1,102	1,440	2,634	3,830	7,249	2,831	1,669	1,000	2,678	5,193	1,730	2,227
21	1,104	1,583	2,508	4,696	6,853	2,725	1,582	1,917	2,264	4,952	1,948	2,245
22	725	1,495	2,962	5,088	7,041	2,227	1,562	1,841	2,311	4,972	2,114	2,302
23	1,297	1,589	3,287	4,780	7,496	2,124	936	1,575	2,351	5,153	2,075	2,162
24	1,231	1,535	3,326	4,818	5,572	2,184	1,555	1,646	1,605	4,654	2,082	1,043
25	1,641	1,512	3,130	4,040	5,490	1,053	1,735	1,558	3,190	5,386	2,102	884
26	1,400	793	3,154	3,285	5,251	1,607	1,838	1,558	3,065	4,879	1,099	1,987
27	1,240	1,508	3,402	4,831	4,854	2,827	2,129	841	2,330	4,571	2,080	2,238
28	1,393	1,504	3,266	4,480	5,749	1,859	2,017	1,526	2,375	3,113	1,985	2,366
29	621	.....	2,812	3,163	5,376	2,122	1,858	1,599	2,245	1,006	2,113	2,432
30	1,361	.....	2,688	2,530	4,459	2,132	989	1,763	2,277	3,089	1,298	2,380
31	1,437	.....	2,753	.....	4,801	.....	1,739	1,532	.....	2,995	.....	1,139

Monthly discharge of St. Croix River near St. Croix Falls, Wis., for 1910–11.

[Drainage area, 5,930 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1910.					
January	3,950	2,495	3,050	0.514	0.59
February	4,150	2,458	3,080	.519	.54
March	9,871	2,875	5,970	1.01	1.16
April	5,588	1,957	3,930	.663	.74
May	5,457	790	2,760	.465	.54
June	3,174	550	1,870	.315	.35
July	1,838	75	1,360	.229	.26
August	1,700	393	1,340	.226	.26
September	1,821	606	1,420	.239	.27
October	1,951	602	1,520	.256	.30
November	1,727	671	1,340	.226	.25
December	1,953	629	1,290	.218	.25
The year	9,871	75	2,410	.406	5.51
1911.					
January	1,693	557	1,160	.196	.23
February	1,597	793	1,420	.239	.25
March	3,402	819	2,300	.388	.45
April	5,088	1,851	3,430	.578	.64
May	7,249	962	4,020	.678	.78
June	5,870	1,053	3,170	.535	.60
July	3,468	928	1,770	.298	.34
August	2,148	841	1,770	.298	.34
September	4,422	1,012	2,150	.363	.40
October	5,386	1,006	3,830	.646	.74
November	2,669	1,099	2,030	.342	.38
December	2,432	884	1,990	.336	.39
The year	7,249	557	2,420	.408	5.54

KETTLE RIVER NEAR SANDSTONE, MINN.

Location.—At the quarries of the Barber Asphalt Co. at Banning, 3 miles above Sandstone; no tributaries within several miles.

Records available.—October 18, 1908, to December 31, 1911.

Drainage area.—825 square miles.

Gage.—Vertical staff; datum unchanged since established.

Channel.—Permanent; bedrock.

Regulation.—The nearest dam is at Sandstone, 3 miles below, but as the fall between the two points is heavy, the station is above its influence.

Winter flow.—The gage is 50 feet above decided rapids, which remain open through the winter except for very short periods of extremely cold weather, when they may freeze and cause backwater. The river very seldom freezes entirely over at the gage, so it is probable that except for the few days when the rapids freeze the open channel rating curve applies closely to the winter flow. This curve has therefore been used in computing winter discharge. During January, 1911, the river at the gage remained open. Ice formed on the rapids during the night, but was dislodged by afternoon. Therefore, any gage readings taken in the morning would have been somewhat in error owing to backwater. Gage heights for January, published in the following table, are reported by the observer as having been read at 1 p. m. Effect of backwater has been considered in making the estimate of discharge for January, given in the following table of monthly discharge.

Accuracy.—As the stream flows through solid rock at the measuring section, this rating curve, which has been furnished by the Kettle River Co., should hold permanently; it has been checked by the Geological Survey. Conditions are exceptionally favorable for excellent results at this station, and the records should be reliable.

Discharge measurements of Kettle River near Sandstone, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 27	C. R. Adams	1.16	63.6
28	.....do	1.86	71.3
28	.....do	1.21	65.6

NOTE.—Measurements made under ice cover about one-eighth mile below gage.

Daily gage height, in feet, of Kettle River near Sandstone, Minn., for 1911.

[Fred Elstad and D. R. Smith, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.4	1.15	1.1	1.60	2.45	2.40	1.65	2.1	1.4	1.70	1.90	1.40
2	1.4	1.1	1.1	1.65	2.40	2.30	1.5	2.3	1.4	1.70	1.90	1.40
3	1.3	1.1	1.1	1.70	2.30	2.20	1.5	2.4	1.6	1.75	1.85	1.40
4	1.3	1.1	1.1	1.70	2.20	2.70	1.9	2.35	1.9	1.80	1.80	1.40
5	1.2	1.1	1.15	1.65	2.10	3.00	3.1	2.4	2.0	1.75	1.75	1.35
6	1.2	1.1	1.15	1.65	2.05	3.10	3.95	2.3	2.1	1.90	1.70	1.35
7	1.2	1.1	1.2	1.60	1.90	3.05	3.8	2.3	2.4	2.20	1.70	1.30
8	1.2	1.15	1.3	1.70	1.90	2.90	3.4	2.25	2.45	2.35	1.70	1.30
9	1.2	1.15	1.45	1.60	1.90	3.25	3.2	2.2	2.5	2.30	1.75	1.35
10	1.25	1.1	1.45	1.75	1.90	3.30	2.9	2.1	2.6	2.20	1.80	1.35
11	1.25	1.15	1.5	1.95	1.90	3.25	2.6	2.0	2.4	2.15	1.75	1.50
12	1.3	1.15	1.65	2.70	1.90	3.00	2.3	2.0	2.3	2.10	1.75	1.55
13	1.25	1.1	1.75	3.00	1.85	3.05	2.1	1.8	2.2	2.05	1.75	1.50
14	1.25	1.1	1.9	3.20	2.50	2.90	2.0	1.7	2.2	2.10	1.70	1.50
15	1.2	1.1	1.8	3.10	2.90	2.70	1.8	1.65	2.3	2.10	1.70	1.40
16	1.25	1.15	1.75	2.90	3.60	2.50	1.8	1.6	2.4	2.10	1.75	1.45
17	1.25	1.15	1.6	2.80	4.00	2.40	1.7	1.6	2.4	2.20	1.70	1.50
18	1.3	1.15	1.6	2.70	4.20	2.40	1.6	1.55	2.3	2.30	1.70	1.60
19	1.35	1.15	1.55	3.00	4.60	2.30	1.6	1.5	2.2	2.50	1.65	1.80
20	1.4	1.2	1.55	3.70	4.80	2.10	1.5	1.5	2.1	2.50	1.65	1.85
21	1.4	1.15	1.6	3.50	4.50	1.95	1.5	1.6	2.0	2.60	1.60	1.85
22	1.25	1.1	1.7	3.30	4.10	1.85	1.4	1.6	1.9	2.50	1.60	1.90
23	1.2	1.1	1.7	2.90	3.90	1.80	1.4	1.55	1.8	2.50	1.55	2.10
24	1.2	1.1	1.9	2.80	3.60	1.65	1.5	1.5	1.8	2.40	1.50	2.30
25	1.15	1.15	1.8	2.75	3.40	1.60	1.7	1.45	1.8	2.40	1.50	2.45
26	1.15	1.1	1.8	2.60	3.10	1.60	1.75	1.4	1.75	2.30	1.50	2.50
27	1.15	1.1	1.75	2.65	2.85	1.90	1.65	1.45	1.7	2.25	1.45	2.50
28	1.1	1.1	1.7	2.50	2.70	1.90	1.6	1.5	1.75	2.20	1.45	2.60
29	1.1	.....	1.65	2.55	2.65	1.85	1.5	1.55	1.75	2.10	1.45	2.65
30	1.1	.....	1.65	2.40	2.50	1.80	1.6	1.5	1.75	2.00	1.40	2.50
31	1.15	.....	1.6	.....	2.45	.....	1.8	1.5	.....	1.90	.....	2.70

NOTE.—Ice present from Jan. 1 to 31. Nov. 27 observer reported "river partly frozen near gage." Dec. 23 observer reported "rise in river due to ice." Relation of gage height to discharge probably affected by ice about Jan. 1 to 31 and about Dec. 19 to 31. See "Winter flow" in the station description.

Daily discharge, in second-feet, of Kettle River near Sandstone, Minn., for 1911.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	80	70	186	540	515	201	375	136	216	288	136
2	70	70	201	515	465	160	465	136	216	288	136
3	70	70	216	465	420	160	515	186	233	269	136
4	70	70	216	420	675	288	490	288	250	250	136
5	70	80	201	375	860	930	515	330	233	233	124
6	70	80	201	352	930	1,560	465	375	288	216	124
7	70	90	186	288	895	1,440	465	515	420	216	112
8	80	112	216	288	795	1,140	442	540	490	216	112
9	80	148	186	288	1,040	1,000	420	565	465	233	124
10	70	148	233	288	1,070	795	375	620	420	250	124
11	80	160	309	288	1,040	620	330	515	398	233	160
12	80	201	675	288	860	465	330	465	375	233	173
13	70	233	860	269	895	375	250	420	352	233	160
14	70	288	1,000	565	795	330	216	420	375	216	160
15	70	250	930	795	675	250	201	465	375	216	136
16	80	233	795	1,300	565	250	186	515	375	233	148
17	80	186	735	1,600	515	216	186	515	420	216	160
18	80	186	675	1,760	515	186	173	465	465	216	186
19	80	173	860	2,080	465	186	160	420	565	201	.....
20	90	173	1,370	2,240	375	160	160	375	565	201	.....
21	80	186	1,220	2,000	309	160	186	330	620	186	.....
22	70	216	1,070	1,680	269	136	186	288	565	186	.....
23	70	216	795	1,520	250	136	173	250	565	173	.....
24	70	288	735	1,300	201	160	160	250	515	160	.....
25	80	250	705	1,140	186	216	148	250	515	160	.....
26	70	250	620	930	186	233	136	233	465	160	.....
27	70	233	648	765	288	201	148	216	442	148	.....
28	70	216	565	675	288	186	160	233	420	148	.....
29	.....	201	592	648	269	160	173	233	375	148	.....
30	.....	201	515	565	250	186	160	233	330	136	.....
31	.....	186	.....	540	.....	250	160	.....	288	.....	.....

NOTE.—Daily discharge computed from a well-defined rating curve. Discharge Dec. 19 to 31 estimated, because of ice, from observer's notes and climatologic records. Mean discharge Dec. 19 to 31 estimated 166 second-feet, varying from about 150 to 180 second-feet.

Monthly discharge of Kettle River near Sandstone, Minn., for 1911.

[Drainage area, 825 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	[a] 65	0.079	0.09	C.
February	90	70	74.6	.090	.09	B.
March	288	70	176	.213	.25	A.
April	1,370	186	591	.716	.80	A.
May	2,240	269	863	1.05	1.21	A.
June	1,070	186	562	.681	.76	A.
July	1,560	136	411	.498	.57	A.
August	515	136	274	.332	.38	A.
September	620	136	359	.435	.49	A.
October	620	216	406	.492	.57	A.
November	288	136	209	.253	.28	A.
December	.....	.....	152	.184	.21	B.
The year	2,240	.....	347	.421	5.70	

[a] Estimated from one discharge measurement and climatologic records.

NOTE.—See footnote to table of daily discharge.

SNAKE RIVER AT MORA, MINN.

Location.—At the highway bridge three-fourths of a mile south of Mora, in sec. 14, T. 39 N., R. 24 W., below the mouth of Ann River.

Records available.—June 11, 1909, to December 31, 1911.

Drainage area.—422 square miles.

Gage.—Vertical staff; datum unchanged since established.

Channel.—Shifting.

Discharge measurements.—Made from the bridge except during low stages, when they are made at a wading section.

Winter flow.—From December to March measurements are made through the ice to determine the approximate winter discharge.

Regulation.—The logging dams on the river have not produced marked effect on the gage heights. The only dam below Mora is at Pine City, at the outlet of Cross Lake; backwater from this dam extends to a point several miles below the gaging station.

Discharge measurements of Snake River at Mora, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Jan 12[a]	C. J. Emerson	6.63	9.5
Mar. 1[a]	C. R. Adams	6.55	23.0
June 19	S. B. Soulé	6.68	190
July 6	do	5.89	55.6
Sept. 14	do	6.59	159
Dec. 6[b]	do	6.50	46.9

[a] Measurement made under ice cover.
[b] Complete ice cover at gage; average thickness of ice 0.5 foot; average distance water surface to top of ice 0.04 foot.

Daily gage height, in feet, of Snake River at Mora, Minn., for 1911.

[Mrs. Alice Lasher, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	6.55	5.63	6.02	5.95	8.41	6.12	5.82	6.20	6.78	.....
2	.....	.....	.....	5.60	5.98	5.95	7.48	6.10	5.81	6.28	6.80	.....
3	6.60	6.60	6.62	5.60	6.00	6.00	6.62	6.40	5.88	6.41	6.65	.....
4	.....	.....	.....	5.54	5.94	6.26	6.00	6.38	6.01	6.36	6.40	6.4
5	.....	.....	.....	5.60	5.89	7.05	6.00	6.25	6.20	6.40	6.30	.....
6	6.50	.....	.....	5.68	5.88	7.92	5.96	6.16	6.00	6.75	6.20	6.5
7	.....	.....	6.60	5.68	5.80	8.15	6.35	6.09	5.98	7.19	6.20	6.5
8	.....	6.65	.....	5.60	5.80	7.90	6.48	6.02	6.00	7.44	6.20	.....
9	.....	.....	.....	5.60	5.78	6.88	6.42	5.96	6.02	7.42	6.20	.....
10	6.50	6.7	6.40	5.64	5.80	6.02	6.32	6.01	6.10	7.30	6.20	.....
11	.....	.....	.....	5.65	5.75	7.50	6.24	5.99	6.14	7.09	.....	6.65
12	6.62	.....	6.10	5.80	5.82	7.25	6.12	5.94	6.14	6.95	.....	.....
13	6.60	.....	6.00	6.05	5.85	7.40	6.04	5.90	6.02	6.84	6.5	.....
14	.....	6.72	5.80	6.40	5.90	7.55	5.94	5.95	6.54	6.78	.....	6.6
15	.....	.....	5.88	6.45	6.00	7.15	5.89	5.84	7.72	6.70	.....	.....
16	.....	.....	6.12	6.26	6.06	6.95	5.84	5.74	9.40	6.75	6.35	.....
17	6.55	6.80	6.02	6.15	6.25	6.90	5.79	5.68	8.32	6.76	.....	.....
18	.....	.....	6.20	6.06	6.50	6.75	5.71	5.68	7.70	6.85	.....	6.6
19	.....	.....	5.80	6.10	6.98	6.69	5.79	5.68	7.35	6.94	.....	.....
20	6.60	.....	5.85	6.18	8.45	6.59	5.76	5.68	7.06	6.90	6.6	.....
21	.....	6.60	5.80	6.55	7.74	6.32	5.71	5.75	6.85	6.88	.....	6.6
22	6.50	.....	5.68	6.60	7.51	6.24	5.69	5.88	6.67	6.92	.....	.....
23	.....	.....	5.90	6.45	7.21	6.19	5.66	5.74	6.51	7.01	6.4	.....
24	.....	6.60	5.78	6.34	7.06	6.98	5.74	5.56	6.44	7.05	.....	.....
25	.....	.....	5.69	6.26	6.91	6.18	5.71	5.50	6.31	7.10	.....	6.6
26	.....	.....	5.70	6.21	6.72	6.10	5.66	5.55	6.25	7.06	.....	.....
27	6.70	.....	6.05	6.15	6.55	5.98	5.61	5.70	6.20	7.01	6.5	.....
28	.....	.....	5.75	6.11	6.41	7.44	5.69	5.70	6.19	6.91	.....	6.5
29	.....	.....	5.70	6.10	6.25	6.35	5.79	5.70	6.18	6.78	.....	.....
30	.....	.....	5.76	6.10	6.12	7.80	5.73	5.66	6.18	6.70	6.4	.....
31	6.60	.....	5.60	.....	6.05	.....	5.85	5.80	.....	6.68	.....	.....

NOTE.—Ice present Jan. 1 to Mar. 11 (average thickness of ice about 1.5 and 2 feet) and Oct. 28 to Dec. 31; very thin Oct. 28 to Nov. 12; average thickness Nov. 13 to Dec. 31 about 0.4 to 1 foot. Relation of gage height to discharge affected by ice about Jan. 1 to Mar. 11 and Nov. 11 to Dec. 31.

Daily discharge, in second-feet, of Snake River at Mora, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	23	38	73	66	668	86	53	96	196
2	23	36	69	66	368	83	52	107	200
3	25	36	71	71	165	126	58	128	170
4	25	32	64	104	71	123	72	120	126
5	25	36	59	256	71	103	96	126	110
6	25	42	58	503	67	91	71	190	96
7	25	42	51	580	118	82	69	290	96
8	25	36	51	496	140	73	71	357	96
9	30	36	49	217	129	67	73	352	96
10	40	39	51	73	113	72	83	319	96
11	50	40	47	374	102	70	88	266	.....
12	83	51	53	306	86	64	88	232	.....
13	71	77	56	346	76	60	73	208	.....
14	51	126	60	388	64	66	150	196	.....
15	58	134	71	280	59	55	439	180	.....
16	86	104	78	232	55	46	1,000	190	.....
17	73	90	103	221	50	42	638	192	.....
18	96	78	143	190	44	42	433	210	.....
19	51	83	239	178	50	42	332	230	.....
20	56	93	682	159	48	42	258	221	.....
21	51	152	445	113	44	47	210	217	.....
22	42	161	377	102	42	58	174	226	.....
23	60	134	296	95	40	46	145	246	.....
24	49	116	258	239	46	34	133	256	.....
25	42	104	223	93	44	30	112	268	.....
26	43	97	184	83	40	33	103	258	.....
27	77	90	152	69	37	43	96	246	.....
28	47	84	128	357	42	43	95	223	.....
29	43	83	103	118	50	43	93	196	.....
30	48	83	86	464	45	40	93	180	.....
31	36	.....	77	.....	56	51	.....	176	.....

NOTE.—Daily discharge computed from a well-defined rating curve. Mar. 1 to 11, daily discharge estimated, because of ice. Nov. 11 to 30, discharge estimated, because of ice, from semiweekly gage heights, observer's notes, discharge measurement of Dec. 6, and climatologic records; mean discharge 57 second-feet, ranging from about 43 to 90 second-feet.

Monthly discharge of Snake River at Mora, Minn., for 1911.

[Drainage area, 422 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	[a] 10	0.024	0.03	C.
February	.....	.....	[a] 15	.036	.04	C.
March	96	23	47.7	.113	.13	B.
April	161	32	78.4	.186	.21	A.
May	682	49	144	.341	.39	A.
June	580	66	228	.540	.60	A.
July	668	37	97.7	.232	.27	A.
August	126	30	61.4	.145	.17	A.
September	1,000	52	182	.431	.48	A.
October	357	96	216	.512	.59	A.
November	200	.....	[b] 80.7	.191	.21	C.
December	.....	.....	[c] 53	.126	.15	D.
The year	1,000	.....	101	.239	3.27	

[a] Estimated from two ice measurements, semiweekly gage heights, and climatologic records.
[b] See footnotes to table of daily discharge.
[c] Estimated from ice measurement, semiweekly gage heights, observer's notes, and climatologic records.

CANNON RIVER AT WELCH, MINN.

Location.—At highway bridge at Welch, just below a very small tributary and 3 miles above the mouth of Belle Creek.

Records available.—June 7, 1909, to December 31, 1911.

Drainage area.—1,290 square miles.

Gage.—Chain, attached to bridge; datum unchanged since established.

Channel.—Practically permanent except during high water.

Discharge measurements.—Made from the bridge.

Winter flow.—Ice is present from December to March, and during that period measurements are made to determine the winter discharge. (See fig. 1; also fig. 2, p. 124.)

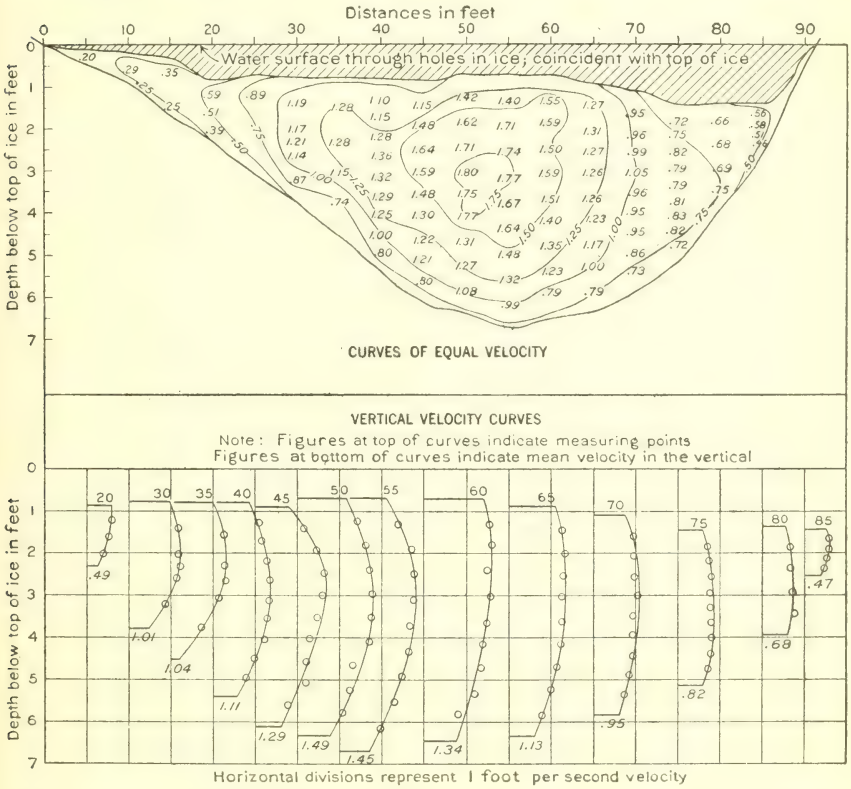

FIGURE 1.—Diagram showing distribution of velocity under ice cover, Cannon River at Welch, Minn.

Regulation.—About 800 feet above the bridge is a dam at which about 40 horsepower is developed. This dam leaks so badly that the operation of the turbine has little effect on the flow.

Maximum flow.—In April of 1888 the high water reached the eaves of the wheelhouse at the mill, 20.1 feet above the datum of the present gage. It is said that this high water was not caused by ice gorging.

Accuracy.—The angle which the current makes at the gaging station necessitates a correction, and, owing to the daily fluctuation of the river during low stage caused by artificial control, the records of flow can not be considered better than fair.

Discharge measurements of Cannon River at Welch, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
May 23	C. J. Emerson	5.08	88.4
Oct. 17	S. B. Soulé	12.30	4,770
18	do	12.22	4,730
Dec. 15	C. J. Emerson	7.75	1,160

Daily gage height, in feet, of Cannon River at Welch, Minn., for 1911.

[E. J. Norell, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.43	5.12	5.49	5.29	5.97	5.39	5.50	7.78	6.80
2	5.88	5.65	5.72	5.24	5.40	5.70	5.74	5.68	7.86	6.61
3	5.58	5.06	5.25	5.32	5.17	5.36	5.62	6.31	7.44	6.42
4	5.58	4.96	5.69	6.45	5.48	5.30	5.23	5.71	6.16	6.32
5	5.23	5.15	5.20	5.92	5.64	5.40	5.72	5.80	5.52	6.10
6	5.54	5.40	5.24	5.95	5.59	5.23	5.86	7.31	6.70	6.15
7	5.34	5.10	5.50	5.35	5.37	5.63	5.84	11.31	6.80	6.30
8	5.67	5.05	5.10	5.64	5.34	5.78	5.83	8.96	7.31	6.34
9	5.76	5.02	5.31	5.35	5.23	5.60	5.84	8.34	7.59	6.38
10	5.54	5.09	5.39	5.48	5.20	5.76	5.68	8.22	7.51	7.30
11	5.49	5.38	5.26	5.34	5.36	5.69	5.46	8.16	7.30	9.15
12	5.28	5.35	5.39	5.59	5.28	5.76	5.84	7.86	7.41	8.85
13	5.17	5.50	5.06	5.60	5.23	5.69	5.83	7.51	7.09	7.98
14	5.53	5.52	5.28	5.40	5.06	5.92	5.83	7.39	6.15	7.75
15	5.56	5.52	5.45	5.42	5.08	5.96	5.84	7.20	5.92	7.70
16	5.43	5.22	5.48	5.50	5.18	5.89	5.80	8.30	5.80	7.20
17	5.16	5.34	5.46	5.78	5.13	5.87	5.42	12.42	6.78	6.60
18	5.54	5.65	5.49	5.45	5.19	5.84	5.46	12.22	6.90	6.92
19	5.14	5.65	5.39	5.40	5.30	5.80	5.70	11.82	.....	6.51
20	5.16	5.45	5.20	5.60	5.39	5.12	5.80	9.62	6.60	6.41
21	5.78	5.65	5.12	5.35	5.27	5.59	5.86	9.58	6.40	6.50
22	5.56	5.66	5.10	5.50	5.03	5.84	5.86	9.15	6.30	6.70
23	5.10	5.45	5.16	5.69	5.24	5.86	5.86	8.94	6.38	6.68
24	5.19	5.18	5.35	5.38	4.98	5.82	5.67	8.32	6.46	6.55
25	5.04	5.65	5.52	5.25	4.99	5.88	5.38	8.00	6.80	6.32
26	4.95	5.28	5.59	5.40	5.23	5.63	5.81	7.49	.....	6.25
27	4.90	5.20	5.13	5.36	5.28	5.34	5.43	8.81	.....	6.32
28	5.06	5.66	5.16	5.48	5.28	5.59	5.76	8.50	.....	6.30
29	5.24	5.24	5.30	5.42	5.20	5.79	5.76	8.35	.....	6.80
30	5.44	5.48	5.14	5.50	5.24	5.36	5.52	8.20	.....	.....
31	5.25	.....	5.28	.....	5.10	5.33	.....	6.90	.....	.....

NOTE.—Ice present about Jan. 1 to Mar. 1, Nov. 12 to Dec. 9, and Dec. 27 to 31.

Daily discharge, in second-feet, of Cannon River at Welch, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	200	154	94	168	124	314	145	170	1,170
2	281	209	229	115	147	223	235	217	1,220
3	190	85	116	130	102	139	201	442	978
4	190	72	220	499	165	126	113	226	384
5	113	99	107	295	206	147	229	254	175
6	180	147	115	306	192	113	274	908	608
7	134	91	170	136	141	203	268	3,900	654
8	215	84	91	206	134	248	264	1,970	908
9	242	80	128	136	113	195	268	1,520	1,060
10	180	90	145	165	107	242	217	1,440	1,020
11	168	143	118	134	139	220	161	1,400	903
12	122	136	145	192	122	242	268	1,220	961
13	102	170	85	195	113	220	264	1,020	795
14	178	175	122	147	85	295	264	951	380
15	185	175	158	152	88	310	268	851	295

Daily discharge, in second-feet, of Cannon River at Welch, Minn., for 1911—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
16	154	111	165	170	104	285	254	1,500	254
17	101	134	161	248	96	278	152	4,900	.....
18	180	209	168	158	105	268	161	4,720	.....
19	97	209	145	147	126	254	223	4,350	.....
20	101	158	107	195	145	94	254	2,490	.....
21	248	209	94	136	120	192	274	2,450	.....
22	185	212	91	170	81	268	274	2,120	.....
23	91	158	101	220	115	274	274	1,950	.....
24	105	104	136	143	75	261	215	1,510	.....
25	83	209	175	116	76	281	143	1,300	.....
26	71	122	192	147	113	203	257	1,000	.....
27	65	107	96	139	122	134	154	1,850	.....
28	85	212	101	165	122	192	242	1,630	.....
29	115	115	126	152	107	251	242	1,530	.....
30	156	165	97	170	115	139	175	1,430	.....
31	116	.....	122	.....	91	132	.....	701	.....

NOTE.—Daily discharge computed from a rating curve fairly well defined between 80 and 5,000 second-feet. Discharge Mar. 1, Nov. 17 to Dec. 9, and Dec. 27 to 31 estimated, because of ice, from observer's notes, climatologic records, and discharge of adjacent drainage areas. Mean discharge Nov. 17 to 30 estimated 230 second-feet, varying from about 200 to 260 second-feet. Mean discharge Dec. 1 to 9 estimated 280 second-feet, varying from about 270 to 300 second-feet.

Monthly discharge of Cannon River at Welch, Minn., for 1911.

[Drainage area, 1,290 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
March	281	65	149	0.116	0.13	B.
April	212	72	145	.112	.12	B.
May	229	85	133	.103	.12	B.
June	499	115	182	.141	.16	B.
July	206	75	119	.092	.11	B.
August	314	94	218	.169	.19	B.
September	274	113	224	.174	.19	B.
October	4,900	170	1,670	1.29	1.49	A.
November	1,220	175	500	.388	.43	B.
December	2,120	250	606	.470	.54	B.

NOTE.—See footnotes to table of daily discharge.

CHIPPEWA RIVER BASIN.

CHIPPEWA RIVER AT CHIPPEWA FALLS, WIS.

Location.—At the highway bridge at Chippewa Falls, Wis., 2,500 feet below the mouth of Duncan Creek.

Records available.—April, 1899, to December 31, 1911. The gage was originally established by the Chippewa Lumber & Boom Co., which has kept a continuous record since 1899. Since 1904 the United States Weather Bureau has obtained gage heights during the flood season of each year. On June 1, 1906, the United States Geological Survey began making discharge measurements and obtained gage heights when no record was obtained by the Weather Bureau. The gage heights as published have been obtained from the following sources: United States Weather Bureau, March to September, 1905, 1907, 1908; April to July, 1909; Chippewa Lumber & Boom Co., October 1 to December 31, 1911; United States Geological Survey.

Drainage area.—5,300 square miles.

Gage.—Staff, painted on one of the cylindrical iron piers at right end of bridge. Graduated to feet and inches, but readings published to feet and hundredths. Datum has not been changed since establishment.

Channel.—Probably permanent.

Discharge measurements.—Made from downstream side of bridge.

Floods.—Maximum stage, according to United States Weather Bureau, was 13.5 feet September 16 and 17, 1903.

Winter flow.—Ice forms about 2 feet in thickness, and the winter flow is considerably modified by backwater caused by ice below the section. On account of the swift water and the proximity of the dam there is considerable open water at the gage.

Regulation.—The power plants of the Chippewa Lumber & Boom Co., about 2,500 feet above the gage, and the holding and releasing of water for logging, modify the normal flow markedly at times.

Accuracy.—The accuracy is affected to a greater or less extent by the operation of the lumber boom and during the winter by ice, but the channel appears to be permanent, and an excellent rating curve has been developed from discharge measurements made during 1906–1909. As the station has not been visited since February 15, 1909, estimates of discharge are withheld until the discharge rating curve is checked by additional measurements.

Daily gage height, in feet, of Chippewa River at Chippewa Falls, Wis., for 1911.

[H. P. Farvell, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.7	0.9	0.7	2.4	1.9	1.8	0.5	.....	.....	1.07	2.01	.....
2	.7	.8	.7	2.3	1.9	2.2	.4	.....	.....	1.08	1.54	1.7
3	.7	.7	.7	2.1	1.9	2.2	.4	.....	.....	2.04	1.06	.....
4	.7	.7	.7	2.0	2.0	2.2	.6	.....	.....	3.06	1.05	.....
5	.7	.75	.7	1.8	2.0	2.6	.8	.....	.....	3.07	1.04	.....
6	.7	.85	.7	1.8	1.9	4.0	.7	.....	.....	7.54	1.06	.....
7	.7	.9	.75	1.7	1.9	4.1	.7	.....	.....	10.55	1.07	.....
8	.7	.8	.8	1.7	1.9	2.8	.7	.....	.....	10.54	1.06	.....
9	.7	.8	.8	1.7	1.4	2.5	.8	.....	.....	8.52	1.08	1.6
10	.7	.7	.9	1.6	1.5	2.4	1.0	.....	.....	6.54	1.08	.....
11	.7	.7	1.0	1.8	2.0	1.8	1.0	.....	.....	5.52	1.08	.....
12	.7	.7	1.35	1.2	1.7	1.8	1.0	.....	.....	4.06	1.08	.....
13	.7	.7	1.5	2.7	1.3	1.3	.8	.....	.....	3.08	1.08	.....
14	.7	.7	1.35	3.5	1.3	1.2	.8	.....	.....	3.08	1.04	.....
15	.7	.7	1.4	2.4	1.7	1.6	.5	.....	.....	3.01	1.04	.....
16	.7	.7	1.6	3.0	1.9	1.3	.3	.....	.....	3.51	1.04	3.6
17	.7	.7	1.7	2.8	1.9	1.2	.4	.....	.....	6.02	.....	.....
18	.7	.7	1.7	2.6	1.9	1.1	.3	.....	.....	6.57	.....	.....
19	.7	.8	1.7	2.5	1.9	1.1	.3	.....	.....	7.06	.....	.....
20	.7	.8	1.6	2.6	2.0	.9	.4	.....	.....	6.06	.....	.....
21	.7	.8	1.55	3.4	3.1	.8	.4	.....	.....	5.54	.....	.....
22	.7	.8	1.6	2.8	4.2	.8	.4	.....	.....	5.02	.....	.....
23	.7	.8	1.65	2.7	4.0	.7	.3	.....	.....	4.06	.....	2.6
24	.7	.8	1.85	2.8	4.5	.7	.4	.....	.....	4.00	.....	.....
25	.7	.8	2.05	2.6	4.5	.7	.4	.....	.....	3.54	1.6	.....
26	.7	.7	2.1	2.3	3.8	.7	.5	.....	.....	3.06	.....	.....
27	.7	.7	2.1	2.4	3.0	.7	.5	.....	.....	3.05	.....	.....
28	.7	.7	2.0	2.1	2.8	.6	.5	.....	.....	3.02	.....	.....
29	1.0	.....	2.75	1.8	2.5	.6	.6	.....	.....	2.08	.....	.....
30	1.0	.....	2.7	1.9	2.1	.5	.3	.....	.....	2.04	.....	2.5
31	1.0	.....	2.8	.....	1.8	.....	.5	.....	.....	2.02	.....	.....

NOTE.—Relation of gage height to discharge probably affected by ice about Jan. 1 to Mar. 15, Nov. 9 to Dec. 14, and Dec. 25 to 31.

RED CEDAR RIVER AT CEDAR FALLS, WIS.

Location.—At the highway bridge at the outskirts of Cedar Falls, Wis., 4½ miles above the crossing of the Chicago, St. Paul, Minneapolis & Omaha Railway.

Records available.—April 1, 1909, to December 31, 1911.

Gage.—Staff fastened to bridge pier; datum unchanged since establishment.

Channel.—Probably permanent.

Discharge measurements.—No discharge measurements have been made, and the station has not been visited since the gage was established.

Winter flow.—Winters are severe in this locality, but the gage heights at the section do not appear to be much affected by ice, probably because of the rapids a short distance below the station, which, ordinarily, do not entirely freeze over.

Daily gage height, in feet, of Red Cedar River at Cedar Falls, Wis., for 1911.

[Olaf Oas, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.0	2.0	2.2	2.5	2.4	2.4	2.3	2.2	1.9	2.2	2.8	2.6
2	2.0	2.0	2.3	2.5	2.4	2.5	2.0	2.2	1.9	2.3	2.8	2.6
3	2.0	2.0	2.3	2.5	2.4	2.6	2.3	2.2	1.7	2.4	2.8	2.6
4	2.0	2.0	2.4	2.4	2.3	2.5	2.4	2.3	2.1	2.55	2.8	2.6
5	2.0	2.0	2.5	2.4	2.3	2.7	2.35	2.3	2.1	2.8	2.8	2.6
6	2.0	2.0	2.4	2.3	2.2	2.7	2.3	2.0	2.0	3.9	2.8	2.6
7	2.0	2.0	2.4	2.3	1.9	2.7	2.2	2.2	2.0	5.35	2.8	2.6
8	2.0	2.0	2.4	2.3	2.2	2.6	2.1	2.2	2.1	5.4	2.7	2.6
9	2.0	2.0	2.4	2.2	2.1	2.6	2.0	2.1	2.2	4.15	2.7	2.6
10	2.0	2.0	2.1	2.2	2.2	2.5	2.3	2.1	2.2	3.7	2.7	2.6
11	2.0	2.0	1.8	2.2	2.1	2.3	2.2	2.1	2.2	3.35	2.6	2.6
12	2.0	2.05	2.4	2.2	2.1	2.6	2.1	2.1	2.2	3.15	2.75	2.65
13	2.0	2.25	2.8	2.2	2.1	2.55	2.1	1.9	2.2	3.0	2.85	2.7
14	2.0	2.55	2.85	2.3	1.9	2.5	2.0	2.1	2.2	3.0	2.8	2.7
15	2.0	2.45	2.75	2.3	2.25	2.4	2.0	2.1	2.1	2.7	2.8	2.7
16	2.0	2.3	2.6	2.0	2.4	2.25	1.8	2.0	2.1	3.5	2.7	2.7
17	2.0	2.3	2.65	2.6	2.4	2.0	2.1	2.0	1.9	3.6	2.7	2.7
18	2.0	2.3	2.7	2.5	2.4	1.7	2.0	2.0	2.2	4.5	2.6	2.7
19	2.0	2.2	2.8	2.4	2.4	2.0	2.0	2.0	2.2	4.75	2.6	2.6
20	2.0	2.2	2.75	2.3	2.4	2.0	2.0	1.9	2.15	4.55	2.6	2.6
21	2.0	2.1	2.7	2.3	2.1	2.0	2.0	2.1	2.1	4.25	2.6	2.6
22	1.6	2.1	2.6	2.2	2.45	2.0	2.0	2.0	2.0	4.0	2.5	2.5
23	1.6	2.1	2.5	2.1	2.55	2.1	1.9	2.0	2.0	3.95	2.5	2.5
24	1.75	2.1	2.5	2.4	2.7	2.1	2.1	2.0	2.0	3.8	2.5	2.5
25	1.85	2.1	2.5	2.3	2.55	1.7	2.0	2.0	2.0	3.8	2.5	2.5
26	1.95	2.1	2.5	2.3	2.45	2.0	2.0	2.0	2.0	3.65	2.5	2.5
27	2.0	2.1	2.5	2.3	2.3	2.2	2.0	1.8	2.0	3.45	2.5	2.5
28	2.0	2.1	2.6	2.3	2.0	2.2	2.1	2.1	2.1	3.25	2.5	2.5
29	1.7	.....	2.5	2.3	2.4	2.2	2.05	2.1	2.2	3.1	2.5	2.5
30	1.9	.....	2.5	2.0	2.35	2.3	1.9	2.0	2.3	3.05	2.5	2.5
31	1.9	.....	2.5	.....	2.3	.....	2.2	2.0	.....	3.0	.....	2.5

ZUMBRO RIVER AT ZUMBRO FALLS, MINN.

Location.—At the highway bridge at Zumbro Falls, about 8 miles below the mouth of South Branch.

Records available.—June 8, 1909, to December 31, 1911.

Drainage area.—1,120 square miles.

Gage.—Chain, attached to bridge; datum unchanged since established.

Channel.—Slightly shifting.

Discharge measurements.—Made from the bridge.

Winter flow.—Owing to the presence of rapids a short distance above the station and also of springs, open water is practically continuous throughout the winter from the rapids for a distance of several miles downstream. For this reason the daily gage readings are maintained during the winter months. (See fig. 2, p. 124; also fig. 1, p. 119.)

Maximum flow.—The high water of June, 1908, is marked by a spike in a telegraph pole near the railroad station at Zumbro Falls. This is at an elevation of 26.7 feet above the datum of the gage. The high water of April, 1888, reached a stage approximately 29.7 feet, as shown by a mark not so well defined as that of the 1908 flood.

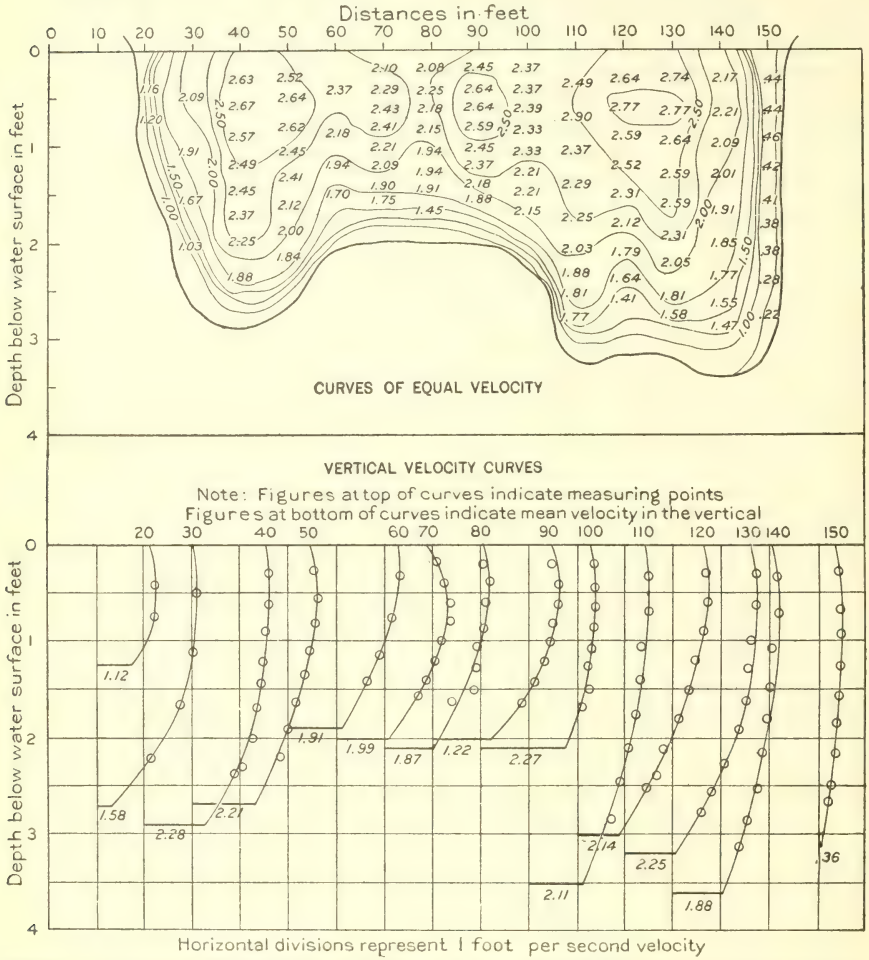

FIGURE 2.—Diagram showing distribution of velocity in open channels, Zumbro River at Zumbro Falls, Minn.

Regulation.—The nearest dam is at Jarretts, but on account of the fall in the river the station is above its influence. The effect of the dams above Zumbro Falls is not felt at the gaging station.

Discharge measurements of Zumbro River at Zumbro Falls, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Mar. 29	C. R. Adams	5.26	211
June 17	S. B. Soulé	5.18	191
Oct. 6	Robert Follansbee	9.48	2,260
7	do	10.57	3,250
Dec. 5[a]	W. G. Hoyt	5.26	247
14[a]	C. J. Emerson	7.02	964
14[a]	do	6.99	932

[a] Open, no backwater.

Daily gage height, in feet, of Zumbro River at Zumbro Falls, Minn., for 1911.

[A. H. Sugg, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.98	4.97	5.57	5.30	5.20	5.24	4.94	4.80	5.10	5.06	6.09	5.44
2	5.00	5.01	5.57	5.29	5.21	5.34	4.88	4.81	5.09	4.99	6.01	5.39
3	.....	4.95	5.54	5.29	5.20	5.29	4.84	4.88	5.04	5.15	5.91	5.30
4	.....	4.97	5.49	5.26	5.20	5.60	4.86	4.85	5.10	5.15	5.86	5.21
5	.....	4.93	5.45	5.26	5.14	5.51	4.85	4.82	5.15	5.38	5.85	5.28
6	5.04	4.87	5.45	5.26	5.10	5.48	4.86	4.95	5.09	9.42	5.82	5.32
7	5.14	4.97	5.45	5.22	5.09	5.30	4.84	5.12	5.05	10.51	5.90	5.32
8	5.10	4.95	5.45	5.26	5.10	5.29	4.84	5.46	5.05	8.76	6.12	5.31
9	5.08	4.95	5.49	5.22	5.09	5.21	4.84	5.22	5.02	7.65	6.10	5.32
10	5.06	4.96	5.56	5.22	5.06	5.20	4.82	5.25	4.98	7.01	6.00	7.25
11	5.04	4.95	5.59	5.24	5.08	5.20	4.82	5.20	4.94	6.62	5.95	11.32
12	5.04	4.96	5.57	5.35	5.06	5.19	4.82	5.16	5.00	6.35	5.78	8.82
13	5.02	5.07	5.56	5.38	5.00	5.10	4.83	5.34	5.00	6.15	5.58	7.55
14	5.03	7.92	5.54	5.38	5.04	5.09	4.80	8.60	4.99	6.20	5.69	7.01
15	5.02	9.55	5.54	5.40	5.28	5.09	4.80	8.38	4.96	6.22	5.58	6.69
16	4.99	8.15	5.40	5.40	5.16	5.19	4.80	7.19	4.94	10.83	5.51	6.35
17	5.00	8.60	5.44	5.35	5.09	5.22	4.78	6.54	4.94	15.93	7.29	6.09
18	5.02	8.00	5.35	5.35	5.10	5.30	.....	6.24	5.16	13.03	7.90	5.89
19	5.00	6.85	5.35	5.35	5.52	5.22	4.85	5.90	5.02	10.92	.....	5.81
20	5.02	6.15	5.37	5.32	5.62	5.15	4.82	5.72	5.09	9.21	7.16	5.80
21	5.06	6.10	5.40	5.30	5.72	5.10	4.80	5.61	5.04	8.20	6.38	5.82
22	4.99	5.83	5.36	5.30	6.65	5.06	4.80	5.50	5.01	7.42	6.05	5.72
23	4.99	5.75	5.35	5.25	6.59	5.06	4.80	5.48	5.02	7.12	5.55	5.66
24	4.98	5.77	5.35	5.21	6.20	5.06	4.80	5.39	5.00	6.88	5.14	5.55
25	4.98	5.79	5.35	5.20	5.88	5.04	4.80	5.30	4.96	6.85	5.45	5.50
26	4.99	5.80	5.34	5.19	5.69	5.04	4.80	5.29	4.99	7.24	5.45	5.38
27	5.03	5.70	5.34	5.12	5.58	5.04	4.80	5.22	4.98	7.05	5.48	5.06
28	5.00	5.60	5.34	5.15	5.46	5.04	4.86	5.16	5.00	6.75	5.19	5.11
29	5.03	.....	5.32	5.18	5.35	5.02	4.80	5.14	4.99	6.54	5.04	5.39
30	5.07	.....	5.34	5.18	5.32	5.02	4.80	5.12	5.04	6.40	5.24	5.41
31	4.99	.....	5.29	.....	5.30	.....	4.79	5.15	.....	6.22	.....	5.41

NOTE.—Relation of gage height to discharge affected by ice about Nov. 17 to 23 and Dec. 29 to 31.

Daily discharge, in second-feet, of Zumbro River at Zumbro Falls, Minn., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	146	144	287	210	187	196	139	116	167	158	520	296
2	149	151	287	208	189	220	129	118	165	147	480	282
3	150	140	278	208	187	208	122	129	156	177	442	256
4	151	144	262	201	187	297	126	124	167	177	424	232
5	154	137	250	201	175	268	124	119	177	236	424	256
6	156	127	250	201	167	259	126	140	165	2,250	406	256
7	175	144	250	192	165	210	122	171	158	3,190	442	256
8	167	140	250	201	167	208	122	253	158	1,960	520	256
9	163	140	262	192	165	189	122	192	153	1,280	520	256
10	160	142	284	192	160	187	119	198	146	938	480	1,070
11	156	140	294	196	163	187	119	187	139	738	461	3,840
12	156	142	287	223	160	185	119	179	149	624	406	1,990
13	153	162	284	231	149	167	121	220	149	540	340	1,230
14	154	1,340	278	231	156	165	116	1,730	147	560	372	938
15	153	2,360	278	236	205	165	116	1,600	142	560	340	788
16	147	1,460	236	236	179	185	116	951	139	3,440	310	624
17	149	1,730	248	223	165	192	113	657	139	8,340	300	520
18	153	1,380	223	223	167	210	118	535	179	5,290	280	442
19	149	792	223	223	271	192	124	404	153	3,520	260	406
20	153	500	228	215	304	177	119	338	165	2,250	250	406
21	160	480	236	210	338	167	116	300	156	1,610	240	406
22	147	378	226	210	704	160	116	265	151	1,150	260	372
23	147	349	223	193	678	160	116	259	153	990	230	356
24	146	356	223	189	519	160	116	233	149	888	221	325
25	146	363	223	187	397	156	116	210	142	863	296	310
26	147	367	220	185	328	156	116	208	147	1,040	296	297
27	154	331	220	171	291	156	116	192	146	964	310	202
28	149	297	220	177	253	156	126	179	149	811	232	212
29	154	.....	215	183	223	153	116	175	147	714	200	240
30	162	.....	220	183	215	153	116	171	156	646	244	230
31	147	.....	208	.....	210	.....	114	177	.....	560	.....	230

NOTE.—Daily discharge computed from two rating curves fairly well defined below 4,000 second-feet. Daily discharge Nov. 17 to 23 and Dec. 29 to 31, estimated, because of ice, from observer's notes, climatologic records, and the flow of the South Branch.

Monthly discharge of Zumbro River at Zumbro Falls, Minn., for 1911.

[Drainage area, 1,120 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	175	146	153	0.137	0.16	B.
February	2,360	127	512	.457	.48	B.
March	294	208	248	.221	.25	A.
April	236	171	205	.183	.20	A.
May	704	149	252	.225	.26	A.
June	297	153	188	.168	.19	A.
July	139	113	120	.107	.12	A.
August	1,730	116	346	.309	.36	A.
September	177	139	154	.138	.15	A.
October	8,340	147	1,500	1.34	1.54	B.
November	520	200	350	.312	.35	A.
December	3,840	202	573	.512	.59	B.
The year	8,340	113	384	.343	4.65	

NOTE.—See footnotes to table of daily discharge.

SOUTH BRANCH OF ZUMBRO RIVER NEAR ZUMBRO FALLS, MINN.

Location.—At the Woodville bridge, 1¼ miles above the mouth of the river, in sec. 22, T. 109 N., R. 14 W., 6 miles below the mouth of the Middle Branch.

Records available.—June 16, 1911, to December 31, 1911.

Drainage area.—821 square miles.

Gage.—Chain, attached to bridge.

Channel.—Apparently permanent, data too incomplete to be conclusive. Between the station and the mouth of the river there is a fall of several feet which prevents backwater from the North Branch reaching the station.

Discharge measurements.—Made from the highway bridge.

Winter flow.—From December to March the river is frozen over; measurements are made to determine the winter discharge.

Discharge measurements of South Branch of Zumbro River near Zumbro Falls, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 25	Robert Follansbee	2.44	291
June 16	S. B. Soulé	2.04	120
July 19	do	1.91	84.5
Oct. 7	Robert Follansbee	6.06	2,590
8	do	4.82	1,490
Dec. 5[a]	W. G. Hoyt	2.14	184

[a] No ice in river in vicinity of gage.

Daily gage height, in feet, South Branch of Zumbro River near Zumbro Falls, Minn., for 1911.

[Wallace M. Whipple, observer.]

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.98	1.88	1.98	1.94	2.82	2.18
2	.....	1.95	1.85	1.97	1.93	2.80	2.22
3	.....	1.90	1.83	1.94	2.03	2.75	2.18
4	.....	1.94	1.83	1.97	2.03	2.70	2.15
5	.....	1.94	1.83	2.02	1.99	2.65	2.14
6	.....	1.88	1.94	1.99	3.62	2.69	2.12
7	.....	1.89	1.91	1.98	5.83	2.73	2.14
8	.....	1.88	1.94	1.98	4.70	2.74	2.15
9	.....	1.90	1.94	1.93	3.75	2.75	2.19
10	.....	1.88	2.05	1.93	3.20	2.68	4.00
11	.....	1.82	2.05	1.91	2.93	2.59	6.88
12	.....	1.88	2.04	1.93	2.80	2.52	4.95
13	.....	1.91	2.07	1.91	2.59	2.45	4.00
14	.....	1.82	4.69	1.92	2.55	2.45	3.49
15	.....	1.90	4.44	1.93	2.58	2.45	3.45
16	2.05	1.92	3.49	1.93	5.23	2.34	2.90
17	2.09	1.89	2.97	1.91	10.91	2.34	2.72
18	2.11	1.89	2.64	1.97	7.79	2.33	2.60
19	2.06	1.88	2.43	1.91	6.24	2.25	2.59
20	2.04	1.86	2.30	1.97	5.39	2.20	2.51
21	2.02	1.85	2.24	1.97	4.58	2.19	2.46
22	1.99	1.85	2.18	1.97	4.04	2.22	2.39
23	2.01	1.85	2.19	1.95	3.76	2.23	2.34
24	2.00	1.86	2.09	1.95	3.52	2.23	2.26
25	2.00	1.86	2.09	1.92	3.46	2.20	2.25
26	1.95	1.82	1.98	1.93	3.66	2.20	2.18
27	1.92	1.84	2.02	1.91	3.59	2.13	2.08
28	1.96	1.88	1.99	1.90	3.39	2.00	2.22
29	2.01	1.87	2.02	1.90	3.15	2.08	2.25
30	1.98	1.87	1.98	1.90	3.02	2.20	2.25
31	.....	1.87	1.99	.....	2.90	.....	2.28

NOTE.—Ice present along shore during latter part of December.

Daily discharge, in second-feet, South Branch of Zumbro River near Zumbro Falls, Minn., for 1911.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	108	80	108	97	427	174	16	130	91	745	94	1,820	233	461
2	.....	100	72	105	94	418	188	17	143	82	492	88	6,820	233	384
3	.....	85	68	97	124	397	174	18	150	82	351	105	3,980	229	335
4	.....	97	68	105	124	376	164	19	133	80	268	88	2,660	200	331
5	.....	97	68	120	111	356	160	20	127	75	218	105	1,950	181	299
6	.....	80	97	111	814	372	153	21	120	72	196	105	1,380	178	279
7	.....	82	88	108	2,310	389	160	22	111	72	174	105	1,050	188	252
8	.....	80	97	108	1,450	393	164	23	117	72	178	100	890	192	233
9	.....	85	97	94	884	397	178	24	114	75	143	100	761	192	202
10	.....	80	130	94	598	368	1,020	25	114	75	143	91	729	181	200
11	.....	65	130	88	474	331	2,860	26	100	65	108	94	835	181	174
12	.....	80	127	94	418	303	1,620	27	91	70	120	88	798	156	140
13	.....	88	136	88	331	276	1,020	28	102	80	111	85	693	114	175
14	.....	65	1,450	91	315	276	745	29	117	78	120	85	574	140	165
15	.....	85	1,290	94	327	276	724	30	108	78	108	85	514	181	165
								31	.....	78	111	.....	461	.....	160

NOTE.—Daily discharge computed from a rating curve well defined below 2,900 second-feet. Daily discharge Dec. 28 to 31 estimated, because of ice, from daily gage heights and climatologic records. Data collected during 1912, before the publication of this report, indicate that the maximum discharge in the above table (6,820 second-feet on Oct. 17) may be about 10 per cent too low, but the data are not such as to warrant a revision of the computations at this time.

Monthly discharge of South Branch of Zumbro River near Zumbro Falls, Minn., for 1911.

[Drainage area, 821 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
June 16–30	150	91	118	0.144	0.08	B.
July	108	65	80.7	.098	.11	A.
August	1,450	68	245	.298	.34	A.
September	120	85	97.4	.119	.13	A.
October	6,820	94	1,110	1.35	1.56	B.
November	427	114	271	.330	.37	A.
December	2,860	140	434	.529	.61	B.

NOTE.—See footnotes to table of daily discharge.

ROOT RIVER NEAR HOUSTON, MINN.

Location.—At highway bridge 1 mile east of Houston, in sec. 34, T. 104 N., R. 6 W., 1 mile above the mouth of South Root River, ordinarily an insignificant stream, but during heavy rains overflowing its banks badly and flooding considerable area.

Records available.—May 28, 1909, to December 31, 1911.

Drainage area.—1,560 square miles.

Gage.—Vertical staff; datum unchanged since established.

Channel.—Shifting, scouring out during floods, and gradually filling in afterwards; nearly permanent at low stages.

Discharge measurements.—Made from the bridge.

Winter flow.—From December to March discharge measurements are made through the ice to determine the approximate winter flow.

Regulation.—There is no dam below the station, and the nearest dam above is at Rushford. As the flow is ample at all times for the power generated at that point, it is not held back during certain portions of the day, and thus the dam has no influence on the gage heights at Houston.

Accuracy.—The shifting channel renders it necessary to make more frequent measurements than at other stations, and the results based on them can probably not be considered better than fair or, possibly good, except for low stages, when the channel changes but little.

Discharge measurements of Root River near Houston, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 14	C. J. Emerson	2.25	[a] 310
Mar. 30	C. R. Adams	1.41	352
May 26	Robert Follansbee	1.97	544
Aug. 11	S. B. Soulé	1.55	455
17	do	4.64	[b] 1,790
18	do	3.85	[b] 1,260
19	do	3.32	[b] 1,050
Sept. 22	do	1.59	498
Oct. 19	C. J. Emerson	5.97	2,690
20	do	5.07	2,130
Dec. 13	do	4.14	1,580

[a] Measurement made under ice cover.
[b] River bottom scoured out from 7 to 8 feet deeper by flood since Aug. 11.

Daily gage height, in feet, of Root River near Houston, Minn., for 1911.

[Olaf Larson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	2.00	1.35	1.50	1.50	1.02	1.02	1.60	1.55	2.21	.....
2	.....	.....	2.05	1.25	1.60	1.45	1.00	.99	1.55	1.34	2.16	.....
3	1.90	.....	2.00	1.35	1.44	1.45	.90	.90	1.48	2.29	2.06	.....
4	.....	2.30	1.75	1.30	1.36	1.75	.91	1.02	1.45	3.26	1.99	.....
5	.....	.....	1.65	1.45	1.35	1.66	1.06	1.08	1.42	3.05	1.95	.....
6	.....	.....	1.65	1.42	1.31	1.65	.95	1.30	1.46	3.91	2.00	.....
7	2.00	2.30	1.65	1.36	1.30	1.52	.90	2.06	1.41	6.25	2.05	.....
8	.....	.....	1.55	1.35	1.28	1.40	.90	2.59	1.40	[c]6.53	2.15	.....
9	.....	.....	1.60	1.31	1.28	1.39	.91	1.71	1.36	4.28	2.20	.....
10	2.20	2.30	1.60	1.36	1.26	1.32	.91	1.56	1.34	3.45	2.21	3.95
11	.....	.....	1.65	1.32	1.25	1.28	.84	1.50	1.30	3.00	2.15	8.15
12	.....	.....	1.60	1.35	1.16	1.25	.85	1.45	1.28	2.70	2.05	5.95
13	2.20	2.60	1.55	1.42	1.14	1.25	.85	5.36	1.25	2.50	1.62	4.02
14	2.25	.....	1.55	1.45	1.22	1.25	.82	[b]9.95	1.18	2.40	1.61	3.18
15	.....	[a]9.00	1.40	1.49	1.36	1.15	.92	9.55	1.15	2.34	1.84	2.82
16	2.10	6.55	1.40	1.45	1.24	1.20	.90	6.25	1.11	3.52	1.68	2.55
17	.....	6.00	1.40	1.42	1.22	1.30	.80	4.45	1.11	6.80	1.81	2.32
18	.....	6.35	1.40	1.40	1.18	1.25	.85	3.72	3.58	[d]9.10	1.76	2.10
19	.....	4.30	1.35	1.42	1.15	1.20	.89	3.28	2.71	6.56	3.49	1.80
20	2.20	3.25	1.45	1.39	1.30	1.18	.90	2.91	1.94	4.94	.....	1.80
21	.....	2.75	1.45	1.40	1.44	1.15	.90	2.69	1.74	4.24	.....	1.98
22	.....	2.55	1.40	1.36	3.64	1.08	.82	2.92	1.56	3.75	.....	2.00
23	.....	2.55	1.35	1.32	2.69	1.04	.89	2.80	1.45	3.39	.....	1.90
24	.....	2.60	1.35	1.35	2.44	1.09	.85	2.40	1.40	3.09	.....	1.80
25	2.10	2.40	1.35	1.35	2.14	1.05	.89	2.21	1.34	2.98	.....	1.70
26	.....	2.30	1.35	1.25	1.90	1.05	.85	2.08	1.29	2.80	.....	1.60
27	.....	2.35	1.50	1.25	1.80	1.01	.86	1.94	1.20	2.76	.....	.....
28	2.30	1.95	1.45	1.29	1.68	1.05	.88	1.82	1.21	2.62	.....	.....
29	.....	.....	1.45	1.28	1.58	1.00	.91	1.80	1.26	2.52	.....	.....
30	.....	.....	1.45	1.25	1.44	1.00	.94	1.65	1.29	2.40	.....	.....
31	2.30	.....	1.35	.....	1.41	.....	.82	1.65	.....	2.31	.....	.....

[a] Maximum stage, 9 feet.
[b] Maximum stage, 10.8 feet.
[c] Maximum stage, 6.9 feet.
[d] Maximum stage, 9.4 feet.

NOTE.—Ice present Jan. 1 to Feb. 14 and Nov. 19 to Dec. 31. Average thickness of ice, 1 foot.

Daily discharge, in second-feet, of Root River near Houston, Minn., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	.....	550	347	407	430	314	314	492	479	666
2	.....	.....	570	320	447	418	309	307	479	425	651
3	.....	.....	550	347	389	418	287	287	461	690	621
4	.....	.....	458	332	365	496	289	314	453	1,040	601
5	.....	.....	422	377	362	472	323	327	445	957	590
6	.....	.....	422	368	350	469	298	380	456	1,360	604
7	.....	.....	422	350	347	435	287	585	443	2,980	618
8	.....	.....	390	347	342	405	287	772	440	3,240	648
9	.....	.....	405	335	342	402	289	485	430	1,560	663
10	.....	.....	405	350	337	385	289	446	425	1,130	666
11	.....	.....	422	338	335	375	275	430	415	937	648
12	.....	.....	405	347	313	368	277	418	410	824	618
13	.....	.....	390	368	310	368	277	2,240	403	756	497
14	310	.....	390	377	328	368	271	7,280	386	724	.....
15	.....	4,000	345	389	365	344	291	6,780	380	705	.....
16	.....	3,090	345	377	333	356	287	2,980	370	1,160	.....
17	.....	2,680	345	368	328	380	267	1,660	370	3,510	.....
18	.....	1,570	345	370	318	368	277	1,260	1,190	6,220	.....
19	.....	1,500	330	383	312	356	285	1,050	828	3,270	.....
20	.....	1,010	360	374	347	351	287	902	587	1,960	.....
21	.....	750	360	377	389	344	287	820	530	1,540	.....
22	.....	685	345	365	1,200	327	271	906	482	1,280	.....
23	.....	685	330	353	809	318	285	860	453	1,100	.....
24	.....	700	330	362	717	330	277	724	440	973	.....
25	.....	648	330	362	612	320	285	666	425	929	.....

Daily discharge, in second-feet, of Root River near Houston, Minn., for 1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
26	.....	612	330	335	537	320	277	627	413	860	.....
27	.....	620	375	335	509	311	279	587	391	846	.....
28	.....	530	360	345	477	320	283	553	393	796	.....
29	.....	.....	360	342	451	309	289	547	405	763	.....
30	.....	.....	360	335	415	309	296	506	413	724	.....
31	.....	.....	340	.....	408	.....	271	506	.....	696	.....

NOTE.—Daily discharge computed from two rating curves fairly well defined below 3,600 second-feet, one of which was applied indirectly prior to May 22. Discharge estimated Jan. 1 to Feb. 14 and Nov. 14 to Dec. 31, because of ice, from two discharge measurements, observer's notes, climatologic records, and comparison with flow of the North Branch near Lanesboro, Minn. Mean discharge Feb. 1 to 14 estimated 320 second-feet, varying from about 300 to 500 second-feet. Mean discharge Nov. 14 to 30, estimated 468 second-feet, varying from about 450 to 495 second-feet. Mean discharge Dec. 1 to 31 estimated 875 second-feet, varying from about 400 to 4,700 second-feet.

Monthly discharge of Root River near Houston, Minn., for 1911.

[Drainage area, 1,560 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	.....	.....	[a] 310	0.199	0.23	C.
February	4,000	.....	841	.539	.56	C.
March	570	330	390	.250	.29	B.
April	389	320	356	.228	.25	B.
May	1,200	310	436	.279	.32	B.
June	496	309	372	.238	.27	B.
July	323	267	286	.183	.21	B.
August	7,280	287	1,180	.756	.87	B.
September	1,190	370	474	.304	.34	A.
October	6,220	425	1,430	.917	1.06	B.
November	666	.....	535	.343	.38	C.
December	.....	.....	[a] 875	.561	.65	C.
The year	7,280	.....	624	.400	5.43	

[a] Estimated.

NOTE.—See footnotes to tables of daily gage height and daily discharge.

NORTH BRANCH OF ROOT RIVER NEAR LANESBORO, MINN.

Location.—At the first highway bridge 1 mile above the junction of the North and South branches, in sec. 6, T. 103 N., R. 9 W., in Fillmore County, 2 miles north of Lanesboro, and about 5 miles below a small creek that enters from the west.

Records available.—Gage heights and discharge measurements from January 30, 1910, to December 31, 1911.

Drainage area.—647 square miles.

Gage.—Chain; datum unchanged since established.

Channel.—Probably permanent. As there is more than 10 feet fall between the station and the mouth of the South Branch, there is no danger of backwater from that stream. One thousand feet back from the right bank there is an old channel through which the river formerly flowed. At a stage of 6 feet the flow commences through this old channel. At extreme flood stage the right bank is overflowed for a width of one-fourth mile.

Discharge measurements.—Made from the bridge. At extreme flood stages measurements can be made from the railroad bridge just above the junction with the South Branch.

Winter flow.—From December to about March the river is frozen over; measurements are made to determine the winter discharge.

Discharge measurements of North Branch of Root River near Lanesboro, Minn., in 1910-11.

Date.	Hydrographer.	Gage height.	Discharge.
1910.		*Feet.*	*Sec.-feet.*
Apr. 29	G. A. Gray	2.28	191
June 24	Robert Follansbee	2.09	134
Sept. 2	.....do	2.09	137
1911.			
Mar. 31	C. R. Adams	1.96	90.2
May 26	Robert Follansbee	2.32	217
Aug. 17	S. B. Soulé	3.04	550
Oct. 18[a]	C. J. Emerson	5.87	3,230
18[b]	.....do	5.11	2,400
19	.....do	4.30	1,520
Dec. 12	.....do	3.84	1,070

[a] Morning. [b] Afternoon.

Daily gage height, in feet, of North Branch of Root River near Lanesboro, Minn., for 1911.

[Kresten E. Hoium, observer.]

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.31	2.02	2.04	2.08	1.85	2.05	2.14	2.20	2.60	2.39
2	.....	2.32	2.02	2.12	2.12	1.85	1.90	2.14	2.34	2.54	2.38
3	.....	2.30	2.00	2.10	2.18	1.85	1.94	2.14	3.15	2.50	2.32
4	.....	2.31	1.98	2.05	2.32	1.85	2.05	2.14	3.45	2.45	2.25
5	.....	2.32	1.98	2.08	2.40	1.90	2.02	2.18	3.35	2.45	2.22
6	.....	2.35	1.98	2.08	2.30	1.88	2.05	2.18	5.52	2.49	2.28
7	.....	2.32	2.02	2.05	2.18	1.85	2.95	2.16	6.40	2.62	2.30
8	.....	2.32	1.98	2.05	2.20	1.89	2.29	2.19	4.45	2.70	2.28
9	.....	2.32	1.98	2.02	2.12	1.84	2.28	2.15	3.55	2.70	2.32
10	.....	2.35	2.22	2.02	2.12	1.84	2.14	2.10	3.15	2.70	5.08
11	.....	2.35	2.25	2.00	2.08	1.95	2.10	2.08	2.98	2.68	5.80
12	.....	2.32	2.25	1.98	2.02	1.80	2.06	2.08	2.80	2.60	4.20
13	.....	2.35	2.18	1.98	2.02	1.84	10.30	2.08	2.75	2.21	3.30
14	.....	2.32	2.18	2.02	1.98	1.71	9.80	2.08	2.70	2.30	2.85
15	.....	2.36	2.18	1.98	1.98	1.86	4.98	2.10	2.70	2.50	2.72
16	.....	2.34	2.12	1.92	2.02	1.86	3.65	2.05	4.00	2.48	2.64
17	.....	2.34	2.12	1.98	2.12	1.80	3.31	2.05	6.74	2.65	2.32
18	.....	2.31	2.12	1.98	2.05	1.82	2.86	3.45	5.65	2.50	2.55
19	2.86	2.30	2.12	1.92	2.09	1.86	2.68	2.61	4.25	2.45	2.45
20	2.80	2.32	2.08	1.98	2.08	1.82	2.58	2.32	3.72	2.48	2.50
21	2.74	2.31	2.08	3.48	1.98	1.81	2.50	2.30	3.39	2.30	2.42
22	2.69	2.30	2.08	3.25	1.91	1.80	6.02	2.25	3.18	2.32	2.35
23	2.62	2.28	2.05	2.95	1.90	1.81	2.52	2.22	3.00	2.50	2.35
24	2.56	2.28	2.02	2.60	1.95	1.82	2.40	2.26	2.90	2.32	2.35
25	2.54	2.30	1.95	2.35	1.92	1.82	2.35	2.21	2.90	2.38	2.38
26	2.50	2.32	1.95	2.32	1.98	1.80	2.32	2.12	2.80	2.38	2.42
27	2.46	2.38	2.02	2.25	1.90	1.81	2.25	2.09	2.78	2.32	2.42
28	2.44	2.45	2.02	2.20	1.89	1.85	2.32	2.10	2.76	2.32	2.48
29	.....	2.48	2.02	2.18	1.92	1.82	2.22	2.28	2.70	2.35	2.52
30	.....	2.40	2.05	2.12	1.88	1.80	2.22	2.20	2.64	2.38	2.54
31	.....	2.32	.....	2.08	.....	1.82	2.14	.....	2.60	.....	2.59

NOTE.—Gage record, Mar. 4 to 31, 1911, is questionable. It was found on Mar. 31 that the observer was reading the gage 0.3 foot high. Gage heights above are as reported by the observer. Relation of gage height to discharge affected by ice about Jan. 30 to Mar. 8, 1910, and about Dec. 27 to 31, 1911. May 21, maximum, 4.3 feet at 10 a. m. Oct. 17, maximum, 7.2 feet at 12 noon.

Daily discharge, in second-feet, of North Branch of Root River near Lanesboro, Minn., for 1910–11.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1910.									
1	.....	924	167	196	134	128	199	189	160
2	.....	924	167	185	134	134	189	181	160
3	.....	850	203	185	141	134	171	167	164
4	.....	850	203	196	137	141	171	154	164
5	.....	779	167	185	137	141	1,040	147	160
6	.....	711	185	174	137	141	476	141	164
7	.....	711	203	174	141	150	306	137	154
8	.....	647	167	171	134	160	276	134	154
9	2,040	587	203	181	134	171	234	134	164
10	1,940	587	203	185	134	185	181	131	164
11	1,940	587	203	174	134	185	171	131	160
12	1,080	647	167	171	141	167	167	122	154
13	1,940	647	167	167	137	167	171	122	171
14	1,940	647	185	160	134	203	181	128	171
15	1,830	647	167	154	134	181	185	131	171
16	1,620	647	203	150	137	189	181	128	164
17	1,080	587	242	141	141	199	181	128	164
18	1,080	587	242	141	137	203	171	141	167
19	1,000	587	242	134	134	211	171	141	171
20	924	530	242	141	141	203	181	141	174
21	924	530	242	137	141	196	185	141	181
22	924	530	284	150	141	196	189	150	196
23	425	587	284	150	141	203	181	154	196
24	425	530	250	150	134	189	174	154	174
25	376	425	263	150	134	185	181	160	174
26	376	425	242	150	134	174	185	160	167
27	425	376	234	150	128	167	189	150	167
28	425	376	222	147	122	167	196	150	160
29	476	329	219	137	119	196	189	160	160
30	476	284	203	134	119	203	189	150	160
31	425	.....	199	.....	119	203	.....	160	.....

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.											
1	.....	203	110	116	128	66	119	147	167	329	238
2	.....	195	110	141	141	66	77	147	219	302	235
3	.....	185	104	134	160	66	88	147	617	284	210
4	.....	175	99	119	211	66	119	147	814	263	185
5	.....	170	99	128	242	77	110	160	745	263	175
6	.....	165	99	128	203	72	119	160	2,840	280	196
7	.....	162	110	119	160	66	503	154	3,890	338	203
8	.....	159	99	119	167	75	199	164	1,670	376	196
9	.....	156	99	110	141	63	196	150	887	376	210
10	.....	153	174	110	141	63	147	134	617	376	2,350
11	.....	150	185	104	128	90	134	128	519	367	3,160
12	.....	147	185	99	110	54	122	128	425	329	1,430
13	.....	144	160	99	110	63	9,380	128	400	171	711
14	.....	141	160	110	99	38	8,660	128	376	203	450
15	.....	138	160	99	99	68	2,240	134	376	284	385
16	.....	135	141	82	110	68	962	119	1,250	276	348
17	.....	132	141	99	141	54	718	119	4,320	352	210
18	.....	129	141	99	119	59	456	814	2,990	284	306
19	456	126	141	82	131	68	367	334	1,480	263	263
20	425	123	128	99	128	59	320	211	1,020	276	284
21	396	120	128	834	99	56	284	203	772	203	250
22	371	117	128	679	80	54	3,430	185	635	210	222
23	338	114	119	503	77	56	293	174	530	284	222
24	311	111	110	329	90	59	242	189	476	210	222
25	302	108	90	222	82	59	222	171	476	235	234
26	284	105	90	211	99	54	211	141	425	235	250
27	267	102	110	185	77	56	185	131	415	210	240
28	259	99	110	167	75	66	211	134	405	210	220
29	.....	96	110	160	82	59	174	196	376	222	210
30	.....	93	119	141	72	54	174	167	348	235	200
31	.....	90	.....	128	.....	59	147	.....	329	.....	200

NOTE.—Daily discharge computed from a rating curve well defined below 4,000 second-feet. Discharge estimated Mar. 1 to 31, 1911, because of errors in observed gage heights. Discharge Feb. 1 to Mar. 8, 1910, and Dec. 27 to 31, 1911, estimated, because of ice, from observer's notes, climatologic records, and discharge of adjacent drainage areas. Mean discharge Mar. 1 to 8, 1910, estimated 200 second-feet, varying from about 150 to 350 second-feet.

Monthly discharge of North Branch of Root River near Lanesboro, Minn., for 1910–11.

[Drainage area, 647 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1910.						
February	.....	.....	150	0.232	0.24	D.
March	2,040	150	829	1.28	1.48	C.
April	924	284	602	.930	1.04	B.
May	284	167	212	.328	.38	B.
June	196	134	161	.249	.28	B.
July	141	119	134	.207	.24	B.
August	203	128	177	.274	.32	B.
September	1,040	167	229	.354	.40	C.
October	189	122	146	.226	.26	C.
November	196	154	167	.258	.29	C.
1911.						
February 19-28	456	259	341	.527	.20	C.
March	203	90	137	.212	.24	D.
April	185	90	125	.193	.22	A.
May	834	82	186	.287	.33	A.
June	242	72	123	.190	.21	A.
July	90	38	62.4	.096	.11	A.
August	9,380	77	987	1.53	1.76	A.
September	814	119	181	.280	.31	A.
October	4,320	167	994	1.54	1.78	A.
November	376	171	275	.425	.47	A.
December	3,160	175	459	.709	.82	B.

NOTE.—See footnotes to tables of daily gage height and daily discharge.

WISCONSIN RIVER NEAR RHINELANDER, WIS.

Location.—At the highway bridge about 400 feet below Forbes & Wixson's power plant, about 8 miles southwest of Rhinelander, Wis., in T. 36 N., R. 8 E., sec. 27, 8 miles below the mouth of Pelican River.

Records available.—December 1, 1905, to December 31, 1911.

Gage.—Standard chain gage attached to bridge; datum unchanged.

Channel.—Practically permanent.

Discharge measurements.—Made from downstream side of bridge to which gage is attached.

Winter flow.—The winters are severe, but little, if any, ice forms at the gage.

Regulation.—The natural flow of the stream is much modified by the operation of power plants and by storage above the station.

Accuracy.—The fluctuations of the load on the turbines may affect discharge measurements, but it is thought that the records give the flow at the section accurately. As the station was last visited in July, 1908, estimates of discharge are withheld until the discharge rating curve is checked by further discharge measurements.

Daily gage height, in feet, of Wisconsin River near Rhinelander, Wis., for 1911.

[Geo. N. Kramer, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.3	2.6	2.4	3.3	2.5	2.9	2.2	3.4	3.4	3.4	3.6	2.4
2	2.6	2.3	2.5	3.0	2.3	3.1	1.9	3.9	3.1	3.5	3.5	2.3
3	2.5	2.3	2.3	3.1	2.9	3.0	2.1	3.7	2.2	3.5	3.5	2.5
4	2.5	2.1	2.3	2.9	2.4	1.9	1.8	3.7	2.4	3.4	3.0	2.5
5	2.4	2.0	1.8	2.8	2.5	2.7	2.7	3.7	3.7	3.5	2.7	2.6
6	2.6	2.0	2.4	2.8	2.4	2.7	3.1	2.5	3.7	3.9	3.2	2.3
7	2.4	2.0	2.4	2.8	1.6	2.9	3.4	3.7	3.4	4.5	3.2	2.7
8	2.0	3.1	2.6	2.9	2.2	2.9	3.0	3.7	3.4	5.0	3.0	2.5
9	2.5	3.1	2.6	1.9	2.2	2.7	1.7	3.7	3.4	5.2	3.0	2.6
10	2.5	2.6	3.5	3.1	2.1	2.9	3.1	3.8	2.1	5.0	3.0	3.1
11	2.4	2.7	2.9	3.1	2.5	1.8	3.1	3.7	3.4	4.9	3.0	3.2
12	2.6	2.0	2.0	3.0	2.3	2.5	3.0	3.7	3.5	4.8	2.8	3.6
13	2.5	2.3	2.5	3.1	2.3	2.5	3.0	1.9	3.5	4.5	2.9	3.4
14	2.6	2.4	2.6	3.1	2.2	2.3	2.9	3.8	3.6	4.5	2.7	3.5
15	2.2	2.5	3.0	3.0	2.8	2.3	2.8	3.4	3.4	3.8	2.5	3.4
16	2.5	2.5	2.5	1.9	2.6	2.4	1.8	3.5	3.4	4.5	2.5	3.6
17	2.6	2.7	2.5	3.0	2.6	2.3	3.3	3.7	2.0	4.4	2.6	3.3
18	2.5	2.7	2.8	3.1	2.6	1.8	3.3	3.5	3.6	4.6	2.5	3.4
19	2.6	2.1	1.9	3.4	2.9	2.4	2.7	3.6	3.4	3.9	2.7	3.6
20	2.9	2.6	2.8	3.0	3.5	2.4	2.3	2.1	3.4	3.7	2.5	3.5
21	3.2	2.8	2.9	3.2	2.4	2.4	2.9	3.9	3.5	4.9	2.5	3.3
22	2.0	2.7	2.9	3.4	3.7	2.3	3.0	3.9	3.3	5.2	2.6	3.3
23	2.7	2.9	2.9	2.5	3.6	2.3	1.9	3.8	3.3	4.7	2.4	3.4
24	2.7	3.1	3.0	3.1	3.6	2.4	4.4	3.6	2.1	4.6	2.6	3.7
25	3.1	3.1	3.1	3.0	3.9	1.8	3.6	3.9	3.3	4.4	2.7	3.8
26	2.9	2.7	1.9	2.9	3.9	2.4	3.4	4.0	3.3	4.5	2.9	3.6
27	2.8	2.9	3.3	3.2	2.6	2.4	3.2	2.4	3.4	4.8	2.6	3.2
28	2.8	2.8	3.4	3.2	2.4	2.5	3.2	3.6	3.5	4.6	2.8	3.3
29	2.6	.....	3.3	2.6	2.8	2.5	3.3	3.7	3.5	4.3	2.6	3.4
30	2.9	.....	3.3	2.0	2.9	2.3	1.7	3.7	3.4	4.2	2.5	3.5
31	2.7	.....	3.2	.....	2.9	.....	3.9	3.7	.....	3.4	.....	3.3

NOTE.—No ice reported by observer; relation of gage height to discharge probably not affected by ice.

WISCONSIN RIVER AT MERRILL, WIS.

Location.—At highway bridge at east end of Merrill, Wis., half a mile below the mouth of Prairie River.

Records available.—November 17, 1902, to December 31, 1911.

Drainage area.—2,630 square miles.

Gage.—Standard chain gage attached to bridge; datum unchanged.

Channel.—Probably permanent; current swift.

Discharge measurements.—Made from bridge to which gage is attached.

Winter flow.—Winters are severe, but the swift current prevents the river from freezing across at the gage. Relation between gage height and discharge is, however, affected by backwater, caused by ice at or below the gage.

Regulation.—The flow is affected by operation of power plants above the station, and by storage.

Accuracy.—During the logging season gage heights are affected by backwater, caused by log jams. The records are, however, reliable and accurate except as the gage readings may be affected by conditions above noted. As this station has not been visited since February, 1909, estimates of discharge are withheld until the discharge rating curve is checked by further discharge measurements.

Daily gage height, in feet, of Wisconsin River at Merrill, Wis., for 1911.

[A. F. Luck, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.1	4.3	4.25	6.4	4.5	5.5	3.95	5.55	4.5	6.75	6.3	5.55
2	4.15	4.2	4.3	6.25	4.45	5.4	3.9	5.7	4.5	6.4	5.95	5.55
3	4.2	4.35	3.9	5.9	4.65	5.0	3.65	5.75	4.5	6.90	6.2	5.45
4	4.1	4.5	4.6	5.55	5.05	4.9	3.5	5.15	4.2	7.85	5.2	5.1
5	4.4	4.1	4.4	5.55	5.2	6.25	3.4	4.85	4.6	7.7	5.35	5.45
6	4.65	3.75	4.55	5.45	5.25	6.3	4.0	4.8	4.4	10.85	5.8	5.35
7	4.35	4.5	4.35	5.3	4.4	6.25	4.7	4.95	4.85	11.1	6.05	5.6
8	4.2	4.5	4.5	5.0	4.35	5.45	4.6	5.0	5.8	10.15	5.45	5.5
9	4.05	4.25	4.05	5.25	4.85	5.25	3.6	5.15	4.4	9.1	5.9	5.5
10	3.65	4.8	4.1	5.2	5.35	5.45	4.45	5.4	4.5	8.5	5.8	5.75
11	4.2	4.65	4.6	5.35	5.25	4.85	4.4	5.25	4.7	7.5	5.5	6.4
12	4.15	4.35	4.45	5.9	4.65	4.7	4.55	5.35	4.55	7.5	5.9	6.7
13	4.2	4.1	4.6	6.25	4.85	4.55	4.2	5.35	4.7	7.2	5.0	7.0
14	4.25	4.25	4.9	6.35	4.6	4.4	4.4	5.4	6.55	7.15	5.15	7.0
15	4.1	4.75	4.75	6.55	4.5	4.25	4.35	4.7	6.15	6.95	5.65	6.85
16	4.15	4.7	4.65	6.25	5.75	4.3	4.0	4.75	5.75	7.65	5.75	6.45
17	4.45	4.55	5.2	6.6	5.8	4.1	4.0	4.65	7.2	8.95	5.35	6.45
18	4.45	4.5	5.15	6.05	5.65	4.0	4.15	4.3	6.45	8.95	5.4	6.2
19	4.6	4.45	4.6	6.25	5.65	3.55	5.05	4.65	5.9	9.3	5.45	5.95
20	4.35	4.4	4.6	6.8	6.6	4.0	4.85	4.0	5.35	8.45	5.5	6.15
21	4.85	4.35	5.05	6.3	6.95	4.05	4.3	4.15	5.9	8.0	5.3	6.2
22	4.4	4.2	5.8	6.4	7.0	4.05	4.9	4.8	5.85	7.5	5.45	6.1
23	4.25	4.2	5.9	6.45	7.35	4.05	4.05	5.2	5.55	7.35	5.5	6.1
24	4.4	4.2	5.9	6.2	7.35	4.05	4.8	5.1	5.4	7.2	5.55	5.95
25	4.65	4.45	5.6	5.8	7.25	3.95	4.4	4.9	5.65	7.2	5.5	5.9
26	4.65	4.35	5.95	5.8	6.65	3.6	4.8	5.0	5.15	7.35	5.5	5.85
27	4.3	4.45	6.35	6.05	6.4	3.55	4.75	4.9	5.75	6.95	5.45	5.85
28	4.3	4.3	6.25	4.7	6.6	4.0	4.75	5.15	5.75	6.35	5.65	5.45
29	4.3	.....	6.5	5.2	5.8	4.05	4.75	4.8	6.05	6.2	5.65	5.45
30	4.25	.....	6.6	5.45	5.75	4.05	4.55	4.3	6.4	6.15	5.65	5.5
31	4.55	.....	6.25	.....	5.6	.....	3.95	4.55	.....	6.35	.....	5.35

WISCONSIN RIVER NEAR NECEDAH, WIS.

Location.—At the highway bridge about 3 miles east of Necedah, Wis., on the road from Necedah to Strongs Prairie, 5 miles above mouth of Big Roche a Cri Creek.

Records available.—December 2, 1902, to December 31, 1911.

Drainage area.—About 5,800 square miles.

Gage.—Standard chain gage attached to bridge; datum unchanged.

Channel.—Shifts during floods.

Discharge measurements.—Made from bridge to which gage is attached.

Winter flow.—Ice forms from 1 to 2 feet in thickness, lasts about three months, and modifies the relation between gage heights and discharge.

Accuracy.—As the station was last visited in February, 1909, estimates of discharge are withheld from publication.

Daily gage height, in feet, of Wisconsin River near Necedah, Wis., for 1911.

[Michael Coughlin, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	8.55	6.2	7.65	5.2	5.6	5.45	6.95	8.3	9.0
2	6.0	.....	.....	7.9	6.3	7.25	5.2	5.1	5.4	7.95	8.1	9.35
3	.....	.....	.....	7.55	6.55	7.55	5.4	5.55	5.0	8.25	7.95	9.2
4	.....	.....	.....	7.15	6.45	7.35	5.45	5.8	5.0	8.75	7.45	8.75
5	.....	.....	.....	7.1	6.35	7.65	5.0	6.2	4.5	9.2	7.35	8.8
6	.....	6.1	6.0	7.1	6.35	7.75	5.1	6.1	4.95	10.0	8.35	8.95
7	.....	.....	.....	6.95	6.5	8.8	4.9	5.7	4.75	11.2	7.25	8.8
8	.....	.....	.....	6.85	6.8	9.45	4.75	6.0	5.0	12.55	7.35	8.7
9	5.7	.....	.....	6.7	6.4	8.95	4.9	5.6	5.1	13.7	7.5	8.75
10	.....	.....	.....	6.55	5.8	8.3	5.1	5.9	5.4	16.9	7.7	8.8

Daily gage height, in feet, of Wisconsin River near Necedah, Wis., for 1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	.....	.....	.....	7.0	6.3	7.7	5.3	5.75	5.1	15.4	7.8	7.0
12	.....	.....	5.2	6.45	6.2	7.4	5.0	5.8	5.75	14.0	8.0	7.5
13	.....	6.85	5.0	6.9	6.3	7.25	4.85	5.95	5.45	12.45	8.2	8.4
14	.....	6.25	5.4	7.2	6.35	6.6	5.2	5.7	5.45	11.4	8.0	9.35
15	.....	6.2	5.45	7.55	6.55	6.55	5.4	6.1	5.15	10.4	7.9	10.45
16	5.8	6.15	5.9	8.0	6.5	6.3	5.4	5.7	5.45	10.0	7.4	10.6
17	.....	6.0	6.3	7.9	6.2	6.15	5.1	5.75	6.0	9.9	7.0	10.0
18	.....	6.2	6.5	8.0	7.75	6.25	5.45	5.8	7.1	10.5	6.6	9.2
19	.....	6.1	6.45	7.65	8.75	6.0	5.0	5.75	7.3	12.1	6.55	8.8
20	.....	6.1	6.2	7.4	8.45	6.35	5.35	5.65	7.3	13.6	6.65	8.55
21	.....	6.0	6.4	7.2	8.1	5.75	5.2	5.35	7.1	13.85	7.1	8.0
22	.....	5.8	6.15	7.6	7.95	5.8	5.25	5.55	6.65	12.9	6.9	7.7
23	5.8	5.75	6.2	7.8	9.35	5.7	5.15	5.15	6.7	11.85	7.1	7.6
24	.....	6.0	6.2	7.55	10.35	5.6	5.0	5.55	6.51	10.9	7.0	7.8
25	.....	6.0	7.0	7.6	10.8	5.55	5.35	5.6	6.7	10.0	7.1	7.3
26	.....	6.2	7.4	7.15	11.0	5.45	4.9	5.6	6.85	9.6	6.85	7.1
27	.....	5.7	8.15	6.85	10.8	5.75	5.3	5.1	6.95	9.4	6.8	7.5
28	.....	.....	8.35	6.8	9.8	5.25	5.3	5.25	6.75	9.75	6.8	7.7
29	.....	.....	8.55	6.8	9.1	5.2	5.35	5.45	6.9	9.55	6.75	8.4
30	6.25	.....	9.5	6.6	8.45	5.3	5.55	5.0	7.1	9.1	9.5	8.6
31	.....	.....	8.85	.....	8.2	.....	5.4	5.4	.....	8.45	.....	8.9

NOTE.—Relation of gage height to discharge probably affected by ice about Jan. 1 to Mar. 11. No ice reported by observer during November and December.

WAPSIPINICON RIVER AT STONE CITY, IOWA.

Location.—At the highway bridge at Stone City, Iowa, a short distance above the Chicago, Milwaukee & St. Paul Railway bridge, about 4 miles above the mouth of Buffalo Creek.

Records available.—August 19, 1903, to December 31, 1911.

Drainage area.—1,310 square miles.

Gage.—Chain; attached to bridge. On December 4, 1906, repairs to the bridge resulted in raising the gage box. Gage heights from that date to January 23, 1910, when the change was determined, have been corrected. Corrected gage heights for 1907, 1908, and 1909 were published in Water-Supply Paper 265.

Channel.—Probably permanent.

Discharge measurements.—Made from upstream side of the bridge.

Winter flow.—The relation between gage height and discharge is affected by heavy ice during December, January, February, and a portion of March. Ice forms from 1 to 2 feet in thickness.

Cooperation.—The gage heights at this station are furnished by Frank Dearborn.

Accuracy.—Although only one measurement of discharge has been made since 1906, that one bears out the assumption of permanency of regimen.

The following discharge measurement was made by Follansbee and Kay:

August 2, 1911: Gage height, 2.60 feet; discharge, 118 second-feet.

Daily gage height, in feet, of Wapsipinicon River at Stone City, Iowa, for 1911.

[Frank Dearborn, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.50	4.02	2.90	3.05	3.68	2.55	2.58	3.22	7.00	3.80	3.45
2	.....	.....	3.95	2.95	3.10	3.55	2.50	2.67	3.18	6.05	3.67	3.32
3	.....	.....	3.90	2.88	3.18	3.90	2.50	2.48	3.15	4.42	3.48	3.15
4	2.34	.....	3.78	2.83	3.15	4.10	2.52	2.73	3.10	3.92	3.60	3.10
5	.....	.....	3.72	3.00	3.15	4.88	2.52	2.65	3.10	3.75	3.52	3.10
6	.....	.....	3.70	3.05	3.15	4.62	2.52	2.60	3.08	3.68	3.50	3.32
7	.....	.....	3.60	3.02	3.10	4.40	2.50	2.78	3.05	3.73	3.55	3.45
8	.....	2.45	3.60	3.05	3.02	3.92	2.48	2.62	3.25	3.85	3.58	3.60
9	.....	.....	3.48	3.00	3.00	3.60	2.48	3.82	3.18	3.88	3.65	3.82
10	.....	.....	3.35	3.00	3.00	3.42	2.70	4.58	2.96	3.88	4.15	4.10

Daily gage height, in feet, of Wapsipinicon River at Stone City, Iowa, for 1911—Contd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	2.35	.....	3.28	3.02	2.98	3.30	2.58	4.85	2.98	4.05	4.22	4.05
12	.....	.....	3.10	3.05	2.95	3.22	2.50	5.92	3.05	3.95	4.80	4.20
13	.....	.....	3.08	3.62	2.92	3.15	2.50	4.95	3.13	3.92	5.25	4.42
14	.....	9.05	3.00	3.45	3.10	3.10	2.48	4.25	3.08	4.05	5.10	4.40
15	.....	11.00	3.03	3.30	3.32	2.98	2.45	5.22	2.97	4.35	4.85	4.01
16	.....	10.90	3.00	3.28	3.25	3.00	2.45	6.00	2.88	4.20	4.60	2.98
17	.....	13.33	2.98	3.28	3.18	3.02	2.40	6.22	2.94	4.15	4.45	2.98
18	2.35	10.30	2.95	3.25	3.12	3.15	2.37	5.82	2.90	4.08	4.12	3.40
19	.....	8.10	2.92	3.25	3.05	3.08	2.35	5.60	3.15	4.62	3.25	4.10
20	.....	6.75	2.90	3.30	3.10	3.00	2.38	5.33	2.98	4.92	3.25	6.25
21	.....	5.20	2.95	3.25	3.60	2.95	2.33	5.00	2.95	4.95	3.40	6.52
22	.....	4.65	2.98	3.20	3.80	2.90	2.28	5.40	2.95	4.90	3.65	5.87
23	.....	4.65	2.95	3.18	4.00	2.90	2.28	5.35	2.92	5.20	3.72	4.40
24	.....	4.80	2.95	3.05	3.88	2.90	2.50	4.82	3.05	5.45	3.54	4.05
25	2.85	4.70	2.95	3.00	4.12	2.80	2.32	4.30	2.98	5.70	3.30	3.82
26	.....	4.58	2.98	2.94	3.85	2.75	2.28	3.98	2.95	5.58	3.50	3.80
27	.....	4.40	3.00	2.92	3.55	2.70	2.26	3.72	2.95	5.10	3.85	4.80
28	.....	4.15	3.03	2.90	3.48	2.65	2.25	3.58	2.92	4.28	3.70	5.02
29	.....	.....	2.98	2.98	3.42	2.62	2.38	3.41	3.05	4.10	3.65	5.44
30	.....	.....	2.95	3.02	3.99	2.55	2.45	3.32	3.40	4.08	3.60	4.95
31	.....	.....	2.95	.....	3.80	.....	2.55	3.30	.....	3.88	.....	.....

NOTE.—Feb. 15, observer reported, "Ice breaking up; moved out 4 p. m." Gage heights Feb. 8, Nov. 13 to 30, and Dec. 26 to 30 are to top of ice. Relation of gage height to discharge affected by ice about Jan. 1 to Feb. 15, Nov. 13 to 30, and Dec. 26 to 31.

Daily discharge, in second-feet, of Wapsipinicon River at Stone City, Iowa, for 1911.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	730	209	263	560	112	119	333	2,450	620	445
2	.....	695	226	282	495	101	140	316	1,850	555	380
3	.....	670	203	316	670	101	97	303	930	460	303
4	.....	610	187	303	770	105	157	282	680	520	282
5	.....	580	244	303	1,170	105	136	282	595	480	282
6	.....	570	263	303	1,030	105	123	274	560	470	380
7	.....	520	252	282	920	101	171	263	585	495	445
8	.....	520	263	252	680	97	128	347	645	510	520
9	.....	460	244	244	520	97	630	316	660	545	630
10	.....	395	244	244	430	148	1,010	230	660	795	770
11	.....	361	252	237	370	119	1,160	237	745	830	745
12	.....	282	263	226	333	101	1,770	263	695	1,130	820
13	.....	274	530	216	303	101	1,210	295	680	.....	930
14	.....	244	445	282	282	97	845	274	745	.....	920
15	.....	255	370	380	237	92	1,360	234	895	.....	725
16	5,430	244	361	347	244	92	1,820	203	820	.....	237
17	8,220	237	361	316	252	82	1,950	223	795	.....	237
18	4,890	226	347	290	303	77	1,710	209	760	.....	420
19	3,190	216	347	263	274	74	1,580	303	1,030	.....	770
20	2,290	209	370	282	244	79	1,420	237	1,200	.....	1,970
21	1,350	226	347	520	226	70	1,240	226	1,210	.....	2,140
22	1,050	237	324	620	209	62	1,460	226	1,180	.....	1,740
23	1,050	226	316	720	209	62	1,430	216	1,350	.....	920
24	1,130	226	263	660	209	101	1,140	263	1,490	.....	745
25	1,080	226	244	780	177	68	870	237	1,640	.....	630
26	1,010	237	223	645	162	62	710	226	1,570	.....	550
27	920	244	216	495	148	59	580	226	1,300	.....	450
28	795	255	209	460	136	58	510	216	860	.....	350
29	.....	237	237	430	128	79	425	263	770	.....	300
30	.....	226	252	715	112	92	380	420	760	.....	270
31	.....	226	.....	620	.....	112	370	.....	660	.....	250

NOTE.—High discharge Dec. 20, 21, and 22 is not justified by climatologic records; the relation of gage height to discharge may have been affected by ice, but since there is no evidence of this other than the abnormally high discharge, the open channel rating curve has been applied. Discharge Nov. 13 to 30 and Dec. 26 to 31 estimated, because of ice, from daily gage heights, observer's notes, climatologic records, and discharge of adjacent drainage areas. Mean discharge Nov. 13 to 30 estimated 460 second-feet, varying from about 300 to 900 second-feet.

Monthly discharge of Wapsipinicon River at Stone City, Iowa, for 1911.

[Drainage area, 1,310 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
February 16-28	8,220	795	2,490	1.90	0.92	B.
March	730	209	350	.267	.31	B.
April	530	187	287	.219	.24	B.
May	780	216	397	.303	.35	B.
June	1,170	112	393	.300	.33	B.
July	148	58	90.7	.069	.08	B.
August	1,950	97	860	.656	.76	B.
September	420	203	265	.202	.23	B.
October	2,450	560	993	.758	.87	B.
November	1,130	.....	523	.399	.45	C.
December	2,140	237	663	.506	.58	C.

NOTE.—See footnotes to tables of daily gage height and daily discharge.

ROCK RIVER BELOW MOUTH OF PECATONICA RIVER, AT ROCKTON, ILL.

Location.—At highway bridge 1 mile below the dam and three-fourths mile below the mouth of Pecatonica River.

Records available.—June 28, 1903, to July 20, 1906; October 1, 1906, to March 31, 1909. (A discharge measurement was made May 13, 1903.)

Drainage area.—6,290 square miles.

Gage.—Standard chain gage attached to the downstream side of the first span from the left end of the bridge. Datum raised 1.0 foot October 1, 1906, so that the gage readings since that date are 1.0 foot less than they would have been by the former datum.

Channel.—Practically permanent; bed composed of gravel and small rocks; broken by four piers.

Discharge measurements.—Made from upstream side of 5-span bridge.

Floods.—The highest recorded stage during the period when the gage was in operation was 13.23 feet in 1904. No other records of floods are available.

Winter flow.—The winters in this vicinity are comparatively severe, ice forms on the river but open places generally exist at the gage. Ice jams frequently form below the station and cause backwater at the gage.

Regulation.—The dam and power plant above the station may modify the flow during periods of low water.

Diversions.—A small amount of water is diverted around this station for one or two small power plants.

Accuracy.—Since the amount of the change in datum on October 1, 1906, is only approximately known, the estimates since that date are liable to some error. It is believed, however, that errors from this cause are small. Data are published in this report as recomputed for the 1911 report of the Rivers and Lakes Commission of the State of Illinois. Data were originally published in Water-Supply Papers 98, 128, 171, 207, 245, and 265.

Daily discharge, in second-feet, of Rock River below mouth of Pecatonica River, at Rockton, Ill., for 1903–1909.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1903.								1903.							
1	.....	2,100	4,770	5,350	4,040	3,030	2,400	16	.....	4,400	4,040	8,270	5,350	3,360	.....
2	.....	2,250	4,770	5,150	3,870	3,190	2,550	17	.....	4,580	5,150	8,770	5,150	3,190	.....
3	.....	2,710	4,770	4,960	4,040	3,190	2,400	18	.....	4,220	4,960	9,020	5,150	2,400	.....
4	.....	4,040	4,770	4,770	3,700	3,030	2,400	19	.....	7,070	4,220	8,270	4,580	2,870	.....
5	.....	3,700	4,770	4,580	4,040	3,030	2,550	20	.....	8,270	3,870	7,300	4,770	2,710	.....
6	.....	3,530	4,770	4,400	4,040	2,870	2,400	21	.....	9,520	3,700	6,620	4,580	2,870	.....
7	.....	3,530	4,770	3,870	5,970	2,710	2,250	22	.....	11,300	3,530	6,180	4,580	2,710	.....
8	.....	3,360	4,770	3,870	9,020	2,250	2,250	23	.....	12,000	3,530	5,760	4,220	2,710	.....
9	.....	2,870	4,770	4,580	7,540	2,400	2,400	24	.....	11,500	3,700	5,350	4,220	2,550	.....
10	.....	3,360	4,580	4,770	6,840	2,250	2,250	25	.....	10,800	3,530	4,580	3,870	2,550	.....
11	.....	3,700	3,870	5,150	6,620	2,550	2,400	26	.....	8,520	3,360	4,400	3,870	2,100	.....
12	.....	4,400	3,190	5,550	5,970	2,710	2,250	27	.....	5,760	3,870	4,220	3,700	3,030	.....
13	.....	5,970	3,190	5,150	5,760	3,190	.....	28	1,960	5,760	4,400	4,580	3,530	2,400	.....
14	.....	5,760	3,030	6,620	5,350	3,530	.....	29	1,690	4,770	5,150	4,400	3,360	2,710	.....
15	.....	4,770	3,530	7,300	5,350	3,360	.....	30	2,400	4,960	5,760	4,220	3,360	2,710	.....
								31	.....	4,960	5,350	.....	3,030	.....	.....

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1904.										
1	.....	20,600	5,610	4,010	1,690	1,560	1,620	3,700	2,320	1,690
2	.....	18,000	5,550	4,010	1,690	1,320	1,620	3,280	2,250	1,620
3	.....	16,100	5,150	3,720	1,760	1,210	1,690	3,110	2,030	1,690
4	.....	14,900	4,920	2,870	1,690	1,210	1,590	2,870	2,100	1,690
5	.....	14,200	4,680	3,190	1,620	1,210	1,820	2,630	2,030	1,760
6	.....	13,600	4,600	3,030	1,620	1,320	2,250	3,190	2,030	1,690
7	.....	13,000	4,580	3,030	1,820	1,380	2,030	3,280	1,760	1,690
8	.....	13,000	4,940	3,050	1,960	1,320	1,890	3,030	2,030	1,690
9	.....	13,000	5,550	2,870	2,100	1,230	1,820	2,480	2,030	1,690
10	.....	13,000	6,290	2,790	2,040	1,320	1,830	2,870	2,030	1,690
11	.....	13,000	6,160	2,790	1,890	1,260	1,820	3,530	2,030	1,690
12	.....	12,600	6,100	2,630	1,890	1,160	1,690	4,240	2,100	1,690
13	.....	11,800	6,200	2,550	1,960	1,210	1,690	5,060	1,960	.....
14	.....	11,100	6,200	2,480	1,760	1,100	1,770	5,060	1,690	.....
15	.....	10,300	6,420	2,400	1,690	1,260	1,690	5,550	1,820	.....
16	.....	10,000	6,510	2,250	1,600	950	1,620	4,220	2,030	.....
17	.....	9,520	6,600	2,280	1,440	1,160	1,560	3,360	2,030	.....
18	.....	8,800	6,200	2,180	1,560	1,320	1,690	3,110	1,890	.....
19	.....	8,500	6,180	2,320	1,560	1,160	2,710	3,700	2,030	.....
20	14,900	8,020	5,930	2,100	1,560	1,320	4,580	2,710	1,960	.....
21	14,900	7,730	5,760	2,100	1,440	1,380	4,220	2,480	1,690	.....
22	25,900	7,420	5,510	2,100	1,440	2,100	3,280	2,400	1,820	1,900
23	27,100	6,980	5,190	2,100	1,440	2,550	2,550	2,400	1,820	2,000
24	24,100	7,020	5,110	2,030	1,440	2,870	2,180	2,480	1,690	2,100
25	24,600	7,850	5,170	1,960	1,160	3,030	1,890	2,400	1,820	2,200
26	25,400	7,900	4,920	1,890	1,560	2,400	2,320	2,320	1,960	2,300
27	25,000	7,320	4,770	1,620	2,100	1,820	3,440	2,320	1,690	2,400
28	24,800	6,710	4,400	1,690	1,560	1,960	4,960	2,400	1,690	2,500
29	23,600	6,180	4,310	1,690	1,440	1,560	4,810	2,250	1,690	2,600
30	22,600	5,820	4,200	1,690	1,440	1,690	3,960	2,180	1,820	2,700
31	21,900	.....	4,220	.....	1,440	1,820	.....	2,480	.....	2,800

Daily discharge, in second-feet, of Rock River below mouth of Pecatonica River, at Rockton, Ill., for 1903–1909—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.										
1	.....	19,300	4,960	5,150	5,150	2,550	2,550	1,820	2,250	3,700
2	.....	17,500	4,770	5,060	5,150	2,480	2,790	1,500	2,250	3,700
3	.....	16,300	4,220	4,960	5,150	2,400	4,310	1,690	2,400	2,870
4	.....	15,800	4,220	4,960	4,770	2,320	3,530	1,690	2,250	3,190
5	.....	15,000	3,870	5,150	4,580	3,110	3,700	1,620	2,320	3,030
6	.....	14,800	3,960	6,620	4,400	3,030	3,620	1,690	2,870	3,110
7	.....	14,300	3,870	6,290	4,580	2,870	3,530	1,620	2,710	2,950
8	.....	13,500	3,780	6,400	4,680	2,870	3,530	1,560	3,030	2,950
9	.....	13,000	3,530	6,840	4,490	2,480	3,360	1,320	3,030	2,870
10	.....	12,500	3,780	7,300	4,490	2,400	3,360	1,440	3,110	2,870
11	.....	12,000	4,490	7,070	4,580	2,320	3,530	1,440	2,870	3,030
12	.....	11,000	8,520	7,540	4,680	2,250	3,110	1,560	2,550	2,790
13	.....	10,300	9,020	7,540	4,960	2,100	2,950	1,500	2,550	2,630
14	.....	9,770	10,000	7,540	4,960	2,550	2,710	1,560	2,870	2,790
15	.....	9,020	11,500	7,300	4,770	2,320	2,710	1,500	2,480	2,480
16	.....	8,520	12,300	7,300	4,580	2,250	2,550	1,500	2,400	2,400
17	.....	8,020	11,300	7,300	4,040	2,400	2,480	1,690	2,400	2,480
18	.....	7,300	10,300	7,540	3,780	2,030	2,710	2,100	2,400	2,100
19	.....	7,070	9,770	7,300	3,440	2,260	2,400	4,770	2,400	2,320
20	.....	6,400	10,000	6,840	3,530	3,360	2,180	5,150	2,480	2,250
21	.....	7,070	8,770	7,070	3,360	3,030	2,100	4,580	2,320	2,250
22	.....	7,300	8,020	7,070	3,190	2,480	2,100	4,310	2,400	2,250
23	.....	6,840	7,300	7,300	3,030	2,400	2,100	3,870	2,480	2,250
24	.....	6,400	6,840	7,070	3,030	2,400	2,100	3,620	2,400	2,320
25	21,800	5,970	5,970	6,620	3,030	2,320	1,820	3,530	2,400	1,820
26	22,500	5,550	6,080	5,970	2,550	3,030	2,100	3,440	2,100	2,320
27	22,500	5,550	5,970	5,760	2,550	3,030	2,030	3,190	2,100	2,550
28	21,500	5,450	5,760	5,660	2,630	3,360	1,960	3,190	2,480	2,250
29	21,500	5,250	5,760	5,350	3,030	3,360	1,820	2,950	3,110	2,950
30	21,300	4,770	5,550	4,960	3,030	2,870	1,890	2,950	3,030	5,760
31	20,800	.....	5,550	.....	2,790	2,630	.....	2,790	.....	3,700

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1906.												
1	3,360	7,660	14,000	15,800	4,860	3,110	3,360	.....	.....	1,560	2,100	5,060
2	2,790	6,620	16,000	15,100	4,860	2,870	3,190	.....	.....	1,960	2,250	4,580
3	2,630	8,320	21,900	13,900	4,770	2,550	3,110	.....	.....	1,820	1,960	4,310
4	4,400	7,660	21,000	11,500	4,770	2,030	2,950	.....	.....	1,690	2,100	4,040
5	4,600	10,900	19,000	9,640	4,580	2,550	2,870	.....	.....	1,560	2,030	3,870
6	5,000	11,300	19,600	9,400	4,400	2,550	2,710	.....	.....	1,500	2,180	4,400
7	5,400	8,400	18,600	9,270	4,490	2,550	2,630	.....	.....	1,960	2,180	3,960
8	5,800	.....	17,600	9,400	4,310	2,550	2,400	.....	.....	1,620	2,100	3,280
9	6,200	.....	17,100	10,600	4,220	2,250	2,400	.....	.....	1,560	1,960	3,530
10	6,600	.....	15,900	11,500	4,040	2,250	2,250	.....	.....	1,440	1,960	3,530
11	6,290	.....	15,000	11,500	3,870	2,180	2,250	.....	.....	1,560	1,960	3,440
12	4,580	.....	11,000	10,100	3,870	2,400	2,100	.....	.....	1,560	1,890	3,440
13	3,700	.....	9,140	11,000	3,530	2,250	1,960	.....	.....	1,560	2,030	3,360
14	3,030	.....	9,520	10,000	3,700	2,100	2,030	.....	.....	1,560	1,960	3,360
15	3,530	.....	9,520	9,400	3,700	2,100	2,100	.....	.....	1,440	1,960	3,360
16	15,000	.....	9,020	9,640	3,620	2,100	2,030	.....	.....	1,380	1,820	2,870
17	12,100	.....	9,640	9,140	3,190	1,820	2,100	.....	.....	1,440	1,620	2,870
18	11,800	.....	8,070	8,770	3,110	1,820	1,960	.....	.....	1,440	1,820	2,870
19	12,300	.....	7,320	8,400	2,870	2,030	1,820	.....	.....	1,380	1,560	3,110
20	12,300	.....	6,620	8,020	2,790	1,890	1,960	.....	.....	1,440	1,820	3,190
21	18,100	.....	6,080	7,540	2,950	2,400	.....	.....	.....	1,760	1,820	2,870
22	17,800	.....	5,150	7,420	2,710	2,250	.....	.....	.....	1,760	2,480	2,870
23	13,600	.....	5,550	7,180	2,710	2,400	.....	.....	.....	1,820	2,790	2,870
24	15,800	.....	5,350	6,620	2,710	2,320	.....	.....	.....	1,760	2,480	2,870
25	17,300	.....	5,350	6,180	2,630	2,250	.....	.....	.....	1,820	2,550	2,100
26	17,800	.....	5,860	5,970	2,710	2,480	.....	.....	.....	1,890	3,530	3,700
27	16,900	.....	14,600	5,660	3,030	2,250	.....	.....	.....	1,960	5,350	2,100
28	14,800	.....	14,800	5,610	3,530	2,100	.....	.....	.....	2,100	6,400	2,100
29	13,500	.....	15,800	5,550	3,190	3,030	.....	.....	.....	2,250	6,290	2,320
30	11,800	.....	16,000	4,980	3,870	3,360	.....	.....	.....	2,250	5,860	2,030
31	9,140	.....	15,900	.....	3,700	.....	.....	.....	.....	2,400	.....	4,600

Daily discharge, in second-feet, of Rock River below mouth of Pecatonica River, at Rockton, Ill., for 1903–1909—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	7,070	.....	4,040	12,300	5,550	4,580	3,190	4,960	3,030	9,270	2,790	.....
2	5,970	.....	3,870	11,500	5,550	4,400	3,110	4,580	2,950	9,400	2,630	.....
3	5,760	.....	3,700	9,270	5,060	4,040	3,030	4,310	3,030	8,140	2,480	.....
4	7,540	.....	3,700	8,520	5,250	3,780	2,870	4,220	2,870	7,070	2,630	.....
5	7,180	.....	3,700	8,400	4,580	4,770	5,760	4,220	2,710	6,730	2,870	.....
6	6,730	.....	3,960	8,140	4,400	4,860	5,350	3,870	2,550	6,290	2,630	.....
7	6,730	.....	3,700	8,020	4,220	5,970	4,960	3,700	2,480	5,550	2,480	.....
8	8,770	.....	3,530	8,770	4,220	6,840	4,580	3,530	2,400	5,350	2,550	.....
9	7,300	.....	3,360	9,640	4,220	8,270	4,860	3,780	2,320	4,960	2,480	.....
10	6,960	.....	3,360	9,770	3,530	7,780	4,770	3,700	2,550	4,580	2,320	.....
11	6,400	.....	3,360	9,520	3,700	7,070	3,960	3,440	2,400	4,310	2,250	.....
12	5,550	.....	3,360	8,900	3,360	6,620	7,300	3,190	2,550	4,310	2,400	.....
13	5,350	.....	3,870	8,270	3,030	6,840	7,070	3,110	2,480	4,220	2,400	.....
14	4,490	.....	3,700	8,020	2,550	6,620	6,960	3,030	2,320	3,870	2,030	.....
15	4,490	.....	5,550	7,660	3,030	6,400	5,970	2,870	2,180	3,780	2,400	.....
16	3,360	.....	5,150	7,300	2,870	5,860	5,060	2,870	1,760	3,870	2,250	.....
17	3,360	.....	4,960	6,840	3,030	5,450	4,960	3,700	2,030	3,700	2,180	.....
18	3,360	5,970	4,960	6,840	3,110	4,960	4,580	5,550	3,780	3,620	2,250	.....
19	14,300	6,620	4,860	6,840	2,870	5,550	4,490	4,960	5,760	3,620	2,180	.....
20	16,500	6,840	4,860	6,290	2,710	4,960	4,130	4,860	7,900	3,700	2,250	.....
21	8,270	7,300	4,770	6,180	2,710	4,770	3,870	4,960	9,640	3,360	2,400	.....
22	.....	7,540	4,770	5,550	2,710	4,310	5,150	4,960	9,900	3,190	2,870	.....
23	.....	9,020	4,860	5,250	3,190	4,310	7,780	5,060	9,900	3,030	2,870	.....
24	.....	7,420	5,250	5,350	3,870	4,220	8,520	4,860	8,520	2,870	3,360	.....
25	.....	6,400	5,350	5,350	4,220	4,400	10,300	4,220	5,970	2,870	3,360	.....
26	.....	5,550	5,250	5,060	5,150	4,490	11,100	3,700	4,860	2,870	3,030	.....
27	.....	4,580	5,550	4,580	5,450	4,130	11,000	3,700	4,400	2,710	2,870	.....
28	.....	4,400	5,550	4,580	5,760	3,530	9,770	3,620	5,150	2,870	2,870	.....
29	.....	.....	6,400	4,680	5,150	3,700	9,020	3,280	7,780	2,710	3,030	.....
30	.....	.....	9,520	5,110	4,960	3,360	5,860	3,280	8,520	2,710	3,030	.....
31	.....	.....	10,600	.....	4,580	.....	5,350	3,190	.....	2,710	.....	.....
1908.												
1	2,250	.....	11,600	10,400	8,520	8,270	3,110	2,070	1,540	1,540	1,690	2,400
2	2,790	.....	11,500	9,520	8,470	7,730	3,160	2,030	1,620	1,440	1,560	1,890
3	2,550	.....	11,100	8,770	7,900	7,180	3,360	1,960	1,540	1,440	1,560	1,560
4	2,630	.....	11,300	8,140	7,900	6,730	4,260	1,930	1,560	1,380	1,620	1,960
5	3,030	.....	10,900	7,540	7,970	6,510	5,250	1,720	1,540	1,420	1,590	1,890
6	2,870	.....	14,800	7,730	8,270	6,220	4,920	1,850	1,620	1,380	1,590	1,620
7	2,710	.....	15,300	7,590	8,570	6,730	4,360	1,820	1,420	1,440	1,660	1,960
8	2,710	.....	15,500	7,830	9,020	8,820	3,960	1,760	1,560	1,420	1,380	2,100
9	3,030	.....	15,400	7,660	9,140	7,610	3,560	1,620	1,560	1,420	1,500	2,100
10	2,870	.....	15,800	7,350	8,640	6,660	3,360	1,560	1,440	1,590	1,560	2,180
11	2,400	.....	15,500	6,840	8,400	6,010	2,900	1,590	1,440	1,500	1,540	2,030
12	2,400	8,000	14,800	7,780	8,020	5,390	2,710	1,660	1,500	1,500	1,560	2,100
13	2,870	14,500	14,100	5,970	8,640	6,290	3,060	1,720	1,380	1,380	1,560	1,960
14	2,400	12,700	12,800	6,220	9,070	7,300	2,950	1,850	1,620	1,540	1,460	1,760
15	2,630	10,900	10,600	5,760	10,900	6,960	2,870	1,990	1,440	1,460	1,500	1,890
16	2,550	9,100	10,300	5,860	10,100	5,760	2,950	2,480	1,440	1,380	1,500	1,890
17	2,870	7,300	9,900	5,390	9,770	5,150	3,160	2,280	1,590	1,380	1,320	1,960
18	2,480	7,350	9,770	5,250	10,100	4,770	5,150	2,070	1,500	1,380	1,540	2,130
19	2,710	7,700	9,470	5,060	11,400	4,310	6,080	1,960	1,420	1,440	1,560	2,480
20	2,320	8,720	8,770	5,110	11,900	4,130	6,400	1,990	1,380	1,500	1,540	2,790
21	1,960	8,550	8,140	4,920	11,400	4,580	5,310	1,790	1,380	1,590	1,590	2,630
22	.....	7,980	7,780	4,680	11,000	7,540	3,960	1,660	1,380	1,540	1,620	2,480
23	.....	9,410	7,420	4,580	10,500	8,270	3,160	1,890	1,380	1,560	1,790	2,480
24	.....	7,540	7,070	4,920	10,000	8,470	2,870	1,560	1,440	1,660	2,070	2,320
25	.....	5,820	6,960	4,580	8,770	8,900	2,680	1,660	1,380	1,620	2,370	2,320
26	.....	9,970	6,440	4,580	8,270	8,140	2,630	1,540	1,440	1,590	2,220	2,630
27	.....	9,770	6,620	6,800	7,660	6,140	2,550	1,500	1,380	1,660	2,370	1,760
28	.....	10,300	8,270	7,780	7,070	4,580	2,400	1,790	1,460	1,660	2,370	1,890
29	.....	12,400	9,900	8,570	7,900	3,870	2,100	1,540	1,440	1,720	2,100	2,030
30	.....	.....	10,400	8,520	8,220	3,280	2,070	1,690	1,440	1,660	2,400	2,030
31	.....	.....	10,200	.....	8,400	.....	2,130	1,500	.....	1,690	.....	2,180

Daily discharge, in second-feet, of Rock River below mouth of Pecatonica River, at Rockton, Ill., for 1903–1909—Continued.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1909.				1909.				1909.			
1	2,480	6,520	11,600	11		6,010	12,200	21		4,040	6,180
2	2,520	6,180	11,000	12		6,840	12,200	22		8,220	7,540
3	1,890	4,860	10,000	13		6,290	11,500	23		10,900	8,270
4	1,690	4,960	8,720	14		5,350	9,520	24		13,700	8,770
5	1,890	6,730	8,570	15			6,960	25		11,800	9,270
6		9,900	8,820	16			6,220	26	9,400	12,600	8,770
7		8,770	9,020	17			5,450	27	10,400	13,000	8,520
8		9,140	9,400	18			5,510	28	11,100	12,600	7,900
9		8,640	10,100	19			5,550	29	11,400		7,300
10		6,140	12,000	20			5,660	30	7,180		6,890
								31	6,850		6,730

NOTE.—Daily discharge computed from two rating curves well defined between 1,800 and 9,000 second-feet and fairly well defined above 9,000 second-feet.

Discharge estimated from climatologic and other data, because of ice, as follows:

1903: Dec. 13–18, mean discharge estimated 1,800 second-feet; Dec. 19–25, mean discharge estimated 2,200 second-feet; Dec. 26–31, mean discharge estimated 2,000 second-feet.

1904: Jan. 1 to 31, mean discharge estimated 1,560 second-feet, varying from about 1,400 to 2,000 second-feet; Feb. 1 to 29, mean discharge estimated 1,630 second-feet, varying from about 1,400 to 2,000 second-feet; Mar. 1 to 19, mean discharge estimated about 8,800 second-feet, varying from about 1,600 to 15,000 second-feet; Dec. 13 to 31, mean discharge estimated about 1,950 second-feet, varying from about 1,500 to 2,800 second-feet.

1905: Jan. 1 to 31, mean discharge estimated 2,170 second-feet, varying from about 1,800 to 2,800 second-feet; Feb. 1. to 28, mean discharge estimated 1,780 second-feet, varying from about 1,600 to 2,500 second-feet; Mar. 1 to 24, mean discharge estimated about 10,100 second-feet, varying from about 3,000 to 21,000 second-feet.

1906: Jan. 5 to 10 and Mar. 1 and 2, as listed; Feb. 8 to 28, mean discharge estimated about 10,300 second-feet, varying from about 5,200 to 18,600 second-feet.

1907: Jan. 22 to 28, mean discharge estimated 7,000 second-feet.

1908: Jan. 22 to 31, mean discharge estimated about 1,720 second-feet, varying from about 1,500 to 2,000 second-feet; Feb. 1 to 11, mean discharge estimated about 2,170 second-feet, varying from about 1,500 to 3,000 second-feet; Feb. 12 to 23, as listed.

1909: Jan. 6 to 13, mean discharge estimated 1,400 second-feet; Jan. 14 to 20, mean discharge estimated 1,900 second-feet; Jan. 21 to 23, mean discharge estimated 3,030 second-feet; Jan. 23 to 25, mean discharge estimated 9,000 second-feet; Feb. 15 to 20, mean discharge estimated 4,500 second-feet.

Discharge interpolated Aug. 2 to 8, 1903, Nov. 9, 1904, Jan. 31 and Feb. 1, 1909. Gage was not read Jan. 29 to Mar. 17, nor during December, 1907.

Monthly discharge of Rock River below mouth of Pecatonica River, at Rockton, Ill., for 1903–1909.

[Drainage area, 6,290 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1903.					
July	12,000	2,100	5,630	0.910	1.05
August	5,760	3,030	4,270	.690	.80
September	9,020	3,870	5,600	.905	1.01
October	9,020	3,030	4,830	.780	.90
November	3,530	2,100	2,820	.455	.51
December	2,550		2,150	.347	.40
1904.					
January			1,560	.252	.29
February			1,630	.263	.28
March	27,100		1,430	.231	.27
April	20,600	5,860	10,800	1.74	1.94
May	6,600	4,200	5,420	.876	1.01
June	4,010	1,620	2,510	.405	.45
July	2,100	1,160	1,650	.266	.31
August	3,030	950	1,550	.250	.29
September	4,960	1,560	2,420	.229	.26
October	5,550	2,180	3,130	.506	.58
November	2,320	1,690	2,930	.473	.53
December			2,790	.451	.52
The year	27,100	950	4,070	.646	6.73

Monthly discharge of Rock River below mouth of Pecatonica River, at Rockton, Ill., for 1903–1909—Continued.

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).
	Maximum.	Minimum.	Mean.	Per square mile.	
1905.					
January	.....	.....	2,170	0.345	0.40
February	.....	.....	1,780	.283	.30
March	22,500	.....	12,700	2.02	2.33
April	19,300	4,770	10,100	1.61	1.80
May	12,300	3,530	6,760	1.07	1.23
June	7,540	4,960	6,490	1.03	1.15
July	5,150	2,550	3,970	.631	.73
August	3,360	2,030	2,620	.416	.48
September	4,310	1,820	2,720	.432	.48
October	5,150	1,320	2,570	.408	.47
November	3,110	2,100	2,550	.405	.45
December	5,760	1,820	2,800	.445	.51
The year	22,500	1,320	4,780	.760	10.33
1906.					
January	18,100	2,630	9,620	1.53	1.76
February	.....	.....	9,900	1.57	1.64
March	21,900	5,150	12,500	1.99	2.29
April	15,800	4,980	9,160	1.46	1.63
May	4,860	2,630	3,660	.582	.67
June	3,360	1,820	2,360	.375	.42
July 1–20	3,360	1,820	2,410	.383	.28
October	2,400	1,380	1,720	.273	.31
November	6,400	1,560	2,630	.418	.47
December	5,060	2,030	3,320	.528	.61
The period	21,900	.....	5,820	.924	10.08
1907.					
Jan. 1–28	.....	3,360	6,940	1.10	1.15
Feb. 18–28	9,020	4,400	6,510	1.04	.43
March	10,600	3,360	4,820	.766	.88
April	12,300	4,580	7,420	1.18	1.32
May	5,760	2,550	4,030	.640	.74
June	8,270	3,360	5,230	.832	.93
July	11,100	2,870	5,960	.948	1.09
August	5,550	2,870	3,980	.632	.73
September	9,900	1,760	4,490	.714	.80
October	9,400	2,710	4,460	.708	.82
November	3,360	2,030	2,600	.413	.46
The period	.....	1,760	5,030	.800	9.35
1908.					
January	3,030	.....	2,330	.370	.43
February	.....	.....	6,620	1.05	1.13
March	15,800	6,440	10,900	1.73	1.99
April	10,400	4,580	6,720	1.07	1.19
May	11,900	7,070	9,100	1.45	1.67
June	8,900	3,280	6,410	1.02	1.14
July	6,400	2,070	3,530	.561	.65
August	2,480	1,500	1,810	.288	.33
September	1,620	1,380	1,470	.236	.26
October	1,720	1,380	1,510	.240	.28
November	2,400	1,380	1,720	.273	.30
December	2,790	1,560	2,110	.335	.39
The year	15,800	1,380	4,520	.717	9.76
1909.					
January	11,100	.....	4,010	.638	.74
February	13,700	.....	7,520	1.20	1.25
March	12,200	5,450	8,590	1.37	1.58

NOTE.—See footnotes to tables of daily discharge.

IOWA RIVER BASIN.

IOWA RIVER NEAR IOWA FALLS, IOWA.

Location.—About 1 mile above Iowa Falls and 2 miles below the Northwestern Railway bridge.

Records available.—August 5, 1911, to December 31, 1911.

Gage.—Vertical staff fastened to a maple tree on the north bank of the river.

Channel.—Rock bottom; permanent.

Discharge measurements.—Made at low water by wading in the vicinity of the gage; at high stages made from bridge.

Winter flow.—Affected by ice.

Regulation.—There is a dam 7 miles above the gage at Alden, which is used occasionally. It is thought that the flow at the gage is natural.

The following discharge was estimated by Follansbee and Kay:

August 4, 1911: Gage height, 0.50 foot; discharge, 16 second-feet. The velocity was determined by floats.

Daily gage height, in feet, of Iowa River near Iowa Falls, Iowa, for 1911.

[Albert Kulas, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.40	0.70	0.52	0.70	16	0.59	0.50	0.75	0.60	0.90
2	.....	.42	.65	.50	.75	17	.54	.52	.78	.88	.99
3	.....	.44	.66	.50	.75	18	.55	.60	.62	.56	.94
4	.....	.40	.68	.55	.85	19	.50	.64	.68	.68	.85
5	0.50	.46	.68	.50	.74	20	.50	.50	.65	.71	.88
6	.49	.49	.68	.70	.78	21	.54	.61	.58	.65	.91
7	.48	.46	.68	.55	.78	22	.52	.50	.58	.90	.90
8	.49	.46	.58	.70	.79	23	.50	.52	.72	.55	.86
9	.50	.46	.74	.56	.76	24	.52	.52	.70	.68	.85
10	.58	.56	.65	.72	1.00	25	.49	.65	.58	.70	.92
11	.68	.69	.66	.75	.99	26	.54	.50	.74	.75	.88
12	.70	.52	.58	.65	.85	27	.48	.61	.58	.75	.86
13	.60	.68	.72	.84	.95	28	.50	.50	.72	.71	.84
14	.60	.49	.71	.72	.99	29	.46	.65	.58	.72	.85
15	.58	.65	.50	.62	.92	30	.40	.51	.68	.78	.90
						31	.40	.....	.60	.....	.....

NOTE.—On Nov. 12 the observer reported, "River froze over last night."

CEDAR RIVER NEAR AUSTIN, MINN.

Location.—Just below the dam of the Red Cedar Mill, 2 miles below Austin, in sec. 15, T. 102 N., R. 18 W.

Records available.—May 29, 1909, to December 31, 1911.

Drainage area.—425 square miles.

Gage.—Vertical staff; datum unchanged since established.

Channel.—Somewhat shifting.

Discharge measurements.—Made from a bridge a short distance below the gage.

Winter flow.—The relation between gage height and discharge is little affected by ice, as the gage is near the tailrace of the mill where the river remains open through most of the winter.

Regulation.—Immediately above the station is the water-power plant known as Red Cedar Mill. During the low-water season the water is drawn down below the crest of the dam by the end of the 10 or 12 hour run, and after the turbine is closed the water is held back for several hours before it has risen sufficiently to flow over the crest. Consequently the stage of the river changes consider-

ably during each 24 hours. In order to get a mean gage height the gage is read five times daily, as follows: Before the turbine is started in the morning, one hour after starting, at noon, just before shutting down at night, and one-half hour later.

Accuracy.—During the summer of 1911 grass grew in the channel to such an extent that it caused backwater in varying amount at the gage, as shown by discharge measurements. Therefore the low-water records of 1911 can not be considered better than fair.

Discharge measurements of Cedar River near Austin, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 1	C. R. Adams	4.41	87.9
May 27	Robert Follansbee	4.41	102
Aug. 12	S. B. Soulé	4.98	[a] 106
19	do	4.64	[b] 88.6
Sept. 21	do	4.63	[c] 105
Oct. 17	C. J. Emerson	11.73	3,970
Dec. 12	do	6.36	803

[a] Measurement made by wading. Grass and moss in channel.
[b] Measurement made by wading. River nearly clear of grass.
[c] Measurement made by wading.

Daily gage height, in feet, of Cedar River near Austin, Minn., for 1911.

[J. C. King, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	[a] 3.58	3.98	4.28	4.02	4.21	4.39	4.11	4.34	4.29	3.52	4.91	4.44
2	4.29	4.10	4.20	[a] 3.58	4.16	4.74	[a] 3.50	4.32	4.20	4.28	4.86	3.60
3	4.41	4.00	4.18	4.05	4.12	4.56	4.20	4.28	[a] 3.48	4.23	4.23	3.60
4	4.42	4.03	4.14	4.04	4.07	[a] 4.57	[a] 3.59	4.32	4.33	4.70	4.76	4.30
5	4.21	[a] 3.50	[a] 3.97	4.16	4.05	4.66	4.21	4.23	[a] 3.49	4.70	3.96	3.60
6	3.97	4.15	4.20	4.12	4.07	4.38	4.22	[a] 4.01	4.33	6.16	4.62	3.63
7	3.94	4.00	4.18	4.11	[a] 3.80	4.25	[a] 3.71	4.61	4.45	6.92	4.80	4.31
8	[a] 3.91	4.00	4.20	4.14	4.15	4.20	4.24	4.56	[a] 3.44	6.00	4.80	4.52
9	[a] 3.87	4.02	4.26	[a] 3.89	4.08	4.17	[a] 3.72	4.59	[a] 3.50	5.34	4.79	4.67
10	4.12	[a] 3.44	4.26	4.18	4.02	4.16	4.36	4.94	[a] 3.56	5.01	4.72	5.88
11	4.11	4.08	4.10	4.07	4.04	[a] 3.90	4.15	4.91	4.39	4.77	4.84	8.00
12	4.01	[a] 3.58	[a] 4.11	4.19	4.00	4.09	4.28	4.68	4.12	4.60	3.95	6.30
13	4.00	3.98	4.30	4.34	4.03	4.21	4.19	8.75	4.06	4.61	4.71	5.57
14	4.07	5.41	4.22	4.36	[a] 3.77	4.12	[a] 3.68	[b] 10.59	[a] 3.49	4.68	4.60	5.14
15	[a] 3.42	6.68	4.13	4.32	4.08	4.09	4.28	6.61	[a] 3.50	5.17	4.77	5.09
16	4.12	6.18	4.06	[a] 4.13	4.08	4.14	3.86	5.44	4.34	[c] 10.44	4.46	4.72
17	4.04	6.13	4.07	4.25	4.06	4.18	4.34	4.97	[a] 3.51	11.58	4.31	4.42
18	4.03	5.96	4.12	4.18	4.03	[a] 3.91	4.22	4.71	4.31	8.00	4.45	4.66
19	3.98	5.17	[a] 3.86	4.12	4.04	4.19	[a] 3.63	4.44	4.33	6.65	4.01	4.58
20	3.95	4.99	4.14	4.12	4.14	4.18	4.30	4.27	[a] 3.52	6.08	4.43	4.47
21	4.04	4.65	4.14	4.12	[a] 4.32	4.14	[a] 3.74	4.60	4.33	5.48	4.23	4.30
22	[a] 3.45	4.44	4.08	4.09	5.10	4.19	4.32	4.70	[a] 3.49	5.20	4.27	4.36
23	4.08	4.44	4.04	[a] 3.83	4.98	4.15	[a] 3.75	4.58	[a] 3.61	5.09	4.85	4.38
24	4.04	4.44	4.02	4.16	4.69	4.19	4.14	4.36	[a] 3.73	5.02	3.68	4.11
25	3.98	4.28	3.91	4.07	4.50	[a] 3.95	4.17	[a] 3.52	4.50	5.00	4.14	4.25
26	4.00	[a] 4.09	[a] 3.38	4.02	4.28	4.28	4.20	4.32	4.42	4.97	3.66	4.42
27	4.03	4.32	4.08	4.05	4.22	4.18	4.37	[a] 3.56	[a] 3.52	4.94	4.43	4.33
28	4.02	4.20	4.06	4.05	[a] 4.00	4.12	4.23	4.35	[a] 3.54	4.82	3.66	4.27
29	[a] 3.52	.....	4.10	4.06	4.20	4.08	4.20	4.32	[a] 3.56	4.71	3.60	4.26
30	4.09	.....	4.04	[a] 3.81	[a] 3.95	4.09	[a] 3.76	4.32	4.34	4.69	3.62	4.27
31	4.02	.....	3.99	.....	4.26	.....	4.32	4.04	.....	4.81	.....	3.98

[a] Turbines closed all day.
[b] Maximum stage recorded during day 10.95 feet.
[c] Maximum stage recorded during day 13.68 feet.

NOTE.—Relation of gage height to discharge probably not affected by ice during 1911.

Daily discharge, in second-feet, of Cedar River near Austin, Minn., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7	40	75	44	66	105	30	32	47	8	227	109
2	77	53	65	7	60	141	0	31	38	61	212	24
3	75	42	63	48	55	108	38	27	6	55	73	24
4	70	45	58	46	50	110	0	30	46	132	184	85
5	66	1	39	60	48	126	39	22	6	132	45	24
6	39	59	65	55	50	79	38	5	46	637	148	25
7	36	42	63	54	23	59	5	56	61	1,010	195	86
8	33	42	65	58	59	52	39	51	5	565	195	126
9	29	44	73	31	51	49	5	54	5	315	192	160
10	55	0	73	63	44	47	52	105	8	212	173	578
11	54	51	53	50	46	22	26	98	67	148	206	1,680
12	43	7	54	64	42	37	39	63	35	111	44	774
13	42	40	78	84	45	50	30	2,000	29	113	171	451
14	50	380	68	86	21	41	1	3,200	6	128	144	299
15	0	965	57	81	51	38	38	835	6	261	187	283
16	55	715	49	57	51	42	3	330	61	3,180	113	173
17	46	685	50	72	49	44	38	159	6	3,880	86	105
18	45	640	55	63	45	19	29	104	57	1,680	111	158
19	40	290	28	55	46	45	0	60	58	951	49	139
20	37	223	58	55	58	43	34	41	7	669	107	115
21	46	142	58	55	81	37	1	84	58	416	73	84
22	0	98	51	52	260	41	36	101	6	318	79	94
23	51	98	46	26	217	38	1	82	8	283	209	98
24	46	98	44	60	145	41	20	50	11	261	28	59
25	40	75	33	50	107	20	22	5	84	254	62	76
26	42	52	0	44	75	51	22	45	71	245	26	105
27	45	81	51	47	68	41	37	5	8	236	107	89
28	44	65	49	47	39	35	25	49	8	201	26	79
29	2	.....	53	48	61	31	22	45	8	171	24	78
30	52	.....	46	24	34	32	0	45	66	165	25	79
31	44	.....	41	.....	69	.....	32	22	.....	198	.....	46

NOTE.—Daily discharge computed from a fairly well defined rating curve that was applied indirectly because of shift.

Monthly discharge of Cedar River near Austin, Minn., for 1911.

[Drainage area, 425 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	77	0	42.3	0.100	0.12	B.
February	965	0	181	.426	.44	B.
March	78	0	53.6	.126	.15	B.
April	86	7	52.9	.124	.14	B.
May	260	21	68.3	.161	.19	B.
June	141	19	54.1	.127	.14	C.
July	52	0	22.6	.053	.06	D.
August	3,200	5	253	.595	.69	D.
September	84	5	30.9	.073	.08	C.
October	3,880	8	548	1.29	1.49	B.
November	227	24	117	.275	.31	B.
December	1,680	24	203	.478	.55	B.
The year	3,880	0	136	.320	4.36	

NOTE.—See footnotes to tables of daily gage height and daily discharge.

CEDAR RIVER AT CEDAR RAPIDS, IOWA.

Location.—In the central part of Cedar Rapids, below the dam and between the electric railroad bridge and the Seventh Avenue combination railroad and foot bridge.

Records available.—October 26, 1902, to December 31, 1911.

Drainage area.—6,320 square miles.

Gage.—An inclined staff gage reading from 0 to 15 feet, fastened to posts driven in the right bank of the river in the rear of the Iowa Windmill & Pump Co.'s plant.

Channel.—Rock and gravel; clean of vegetation and nearly permanent.

Discharge measurements.—Made from the upstream side of the First Avenue bridge.

Regulation.—A dam and power plant above the station may modify the flow to some extent during low stage of the river.

Winter flow.—The gage is located where the current is swift and ice seldom forms across the river for the entire width. The relation therefore between the gage and the discharge is affected only slightly by ice.

Accuracy.—On August 1, 1911, it was found by levels that the gage had been raised, presumably by frost, so that footmarks from 8 to 15 feet are from 0.05 to 0.14 foot too high, the maximum error being at 15 feet. The gage was not changed and no corrections have been applied to published gage heights on this account. It will be noted that there are only four days between April 1, 1909, and December 31, 1911, upon which the gage height is greater than 8 feet, so that the effect of the error in gage upon the accuracy of the records is negligible.

On August 1, 1911, it was discovered that the gage observer was making a mistake of 1 foot in his readings, recording them too low by that amount. He stated that the error was made during the high water of 1911. As a result of the discharge comparison noted below it is believed that the observer's statement was in error and that his mistake of 1 foot began with the high water of 1910 rather than with that of 1911. Although the date of beginning this correction is by no means definite, gage heights in the following tables are 1 foot greater than reported by the observer from March 14, 1910, to July 31, 1911. The daily discharge has been computed from corrected gage heights. The period of correction was decided upon after a comparison of the flow of Cedar River at Cedar Rapids and Wapsipinicon River at Stone City, Iowa, from September, 1903, to December, 1911. Although the comparisons indicate that the estimates of discharge for this period are good, the estimates should be used with caution, because the correction applied to the observed gage heights causes changes amounting to several hundred per cent in the estimates of discharge at low water.

The discharge measurement of August 1, 1911, agrees well with measurements in previous years, and the discharge rating curve is well defined between 600 and 34,000 second-feet. The records from August 1 to December 31, 1911, are considered accurate and reliable.

The following discharge measurement was made by Follansbee and Kay:
August 1, 1911: Gage height, 2.78 feet; discharge, 645 second-feet.

Daily gage height, in feet, of Cedar River at Cedar Rapids, Iowa, for 1909–1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.									
1	7.2	6.3	4.2	5.8	3.4	3.4	3.2	2.9	6.7
2	6.8	6.5	4.4	5.6	3.4	3.3	3.2	3.1	7.4
3	6.2	6.8	4.5	5.3	3.3	3.3	3.1	3.2	7.2
4	6.2	6.3	4.6	5.2	3.2	3.3	3.1	3.2	6.6
5	6.1	5.8	4.6	5.0	3.2	3.2	3.1	3.3	6.2
6	6.2	5.5	4.8	4.9	3.2	3.2	3.1	3.3	6.4
7	6.2	5.3	4.8	4.7	3.2	3.2	3.0	3.4	5.8
8	6.0	5.1	4.9	4.6	3.2	3.2	3.0	3.4	5.4
9	5.8	4.9	5.2	4.4	3.2	3.2	3.0	3.5	5.3
10	5.7	4.7	5.4	4.4	3.2	3.2	3.0	3.5	7.5
11	5.6	4.5	5.4	4.4	3.3	3.2	3.0	3.5	8.3
12	5.4	4.4	5.3	4.3	3.3	3.3	3.0	3.5	8.3
13	5.3	4.3	5.2	4.4	3.4	3.3	3.0	3.6	7.8
14	5.3	4.2	5.0	4.4	3.4	3.4	3.0	3.8	7.4
15	5.4	5.5	4.7	4.3	3.4	3.4	3.1	3.8	5.9

Daily gage height, in feet, of Cedar River at Cedar Rapids, Iowa, for 1909–1911—Contd.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.									
16	5.5	6.7	4.6	4.2	3.6	3.4	3.1	4.9	5.9
17	5.4	5.2	4.4	4.1	3.8	3.6	3.0	5.6	.....
18	5.6	5.4	4.3	4.0	4.2	3.8	3.0	6.5	.....
19	5.8	5.6	4.3	3.9	4.4	3.9	3.1	7.6	5.2
20	6.1	5.5	4.3	3.8	4.6	3.8	3.2	7.9	.....
21	6.9	5.3	4.2	3.8	4.2	3.6	3.2	6.7	.....
22	7.4	5.1	4.2	3.7	4.1	3.6	3.2	6.2	.....
23	6.8	4.9	4.2	3.7	4.0	3.5	3.1	5.6	4.4
24	6.3	4.6	4.4	3.6	3.8	3.4	3.1	5.7	.....
25	5.9	4.6	4.5	3.6	3.7	3.4	3.1	5.7	.....
26	5.7	4.4	4.8	3.6	3.6	3.4	3.0	5.5	4.5
27	5.7	4.3	5.4	3.6	3.6	3.3	3.0	5.5	.....
28	5.3	4.2	5.2	3.6	3.5	3.2	3.0	5.6	.....
29	6.9	4.2	5.3	3.6	3.5	3.2	3.0	5.8	.....
30	6.4	4.2	5.6	3.5	3.4	3.2	3.0	5.8	4.2
31	.....	4.2	.....	3.5	3.4	.....	3.0	.....	.....

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	.....	4.0	3.9	4.4	3.8	3.4	3.1	2.8	2.8	2.8	2.7	2.8
2	4.2	.....	.....	4.4	3.7	3.4	3.1	2.8	2.8	2.8	2.7	2.7
3	.....	.....	4.3	4.3	3.6	3.4	3.1	2.8	2.8	2.8	2.7	2.7
4	.....	.....	.....	4.3	3.6	3.4	3.1	2.8	2.8	2.8	2.7	2.7
5	3.9	3.9	4.6	4.4	3.5	3.4	3.0	2.8	2.8	2.8	2.8	.....
6	.....	.....	5.7	4.6	3.5	3.3	3.0	2.8	2.8	2.8	2.7	.....
7	.....	.....	6.0	4.4	3.5	3.3	3.0	2.8	2.8	2.8	2.7	2.9
8	.....	3.8	5.8	4.2	3.5	3.3	3.0	2.7	2.8	2.8	2.7	.....
9	.....	.....	5.5	4.2	3.4	3.3	3.0	2.7	2.8	2.8	2.7	2.9
10	3.7	.....	5.6	4.0	3.4	3.2	3.0	2.7	2.8	2.8	2.7	.....
11	.....	3.9	5.8	4.0	3.4	3.2	3.0	2.6	2.8	2.8	2.8	.....
12	.....	.....	7.6	3.9	3.4	3.2	2.9	2.6	2.8	2.8	2.8	2.8
13	.....	.....	8.6	3.9	3.4	3.2	2.9	2.6	2.7	2.8	2.8	.....
14	3.9	4.0	9.5	3.9	3.3	3.2	2.9	2.6	2.7	2.8	2.8	3.0
15	.....	.....	8.6	4.1	3.3	3.2	2.9	2.6	2.7	2.8	2.8	.....
16	4.2	.....	8.2	4.1	3.3	3.2	2.9	2.7	2.7	2.7	2.8	3.0
17	.....	3.9	7.9	4.0	3.5	3.2	2.8	2.7	2.7	2.7	2.8	.....
18	.....	.....	7.5	3.9	3.6	3.1	2.8	2.8	2.8	2.7	2.8	.....
19	.....	.....	7.1	3.8	3.6	3.1	2.8	2.8	2.8	2.7	2.8	3.1
20	4.3	.....	6.5	3.8	3.6	3.1	2.8	2.8	2.8	2.7	2.8	.....
21	.....	.....	6.0	3.8	3.6	3.1	2.8	3.1	2.8	2.7	2.7	.....
22	.....	3.7	5.6	3.8	3.6	3.1	2.8	3.0	2.8	2.7	2.7	2.9
23	.....	.....	5.7	3.7	3.7	3.1	2.8	2.9	2.8	2.8	2.7	.....
24	.....	.....	5.5	3.7	3.7	3.1	2.8	2.9	2.9	2.8	2.7	2.9
25	4.3	3.6	5.4	3.8	3.8	3.0	2.8	2.8	3.4	2.8	2.7	.....
26	.....	.....	5.3	3.8	3.7	3.0	2.8	2.8	3.3	2.7	2.7	3.0
27	.....	3.6	5.1	3.7	3.6	3.0	2.8	2.8	3.2	2.7	2.7	.....
28	4.3	.....	4.9	3.7	3.5	3.1	2.8	2.9	3.0	2.7	2.7	2.9
29	.....	.....	4.8	3.7	3.5	3.1	2.8	2.9	2.9	2.7	2.7	.....
30	.....	.....	4.6	3.8	3.4	3.1	2.8	2.8	2.9	2.7	2.8	.....
31	.....	.....	4.5	.....	3.4	.....	2.8	2.8	.....	2.7	.....	2.8
1911.												
1	2.5	.....	3.8	3.0	3.1	3.6	2.8	2.9	3.0	5.5	3.6	3.1
2	.....	2.7	3.7	3.0	3.1	3.6	2.8	2.8	3.0	4.6	3.6	3.1
3	2.6	.....	3.7	3.0	3.1	4.1	2.8	2.9	3.0	4.1	3.5	3.2
4	.....	2.8	3.8	3.1	3.1	4.3	2.7	2.9	3.0	3.9	3.5	3.1
5	.....	.....	3.9	3.1	3.1	4.1	2.7	2.8	2.9	3.8	3.5	3.2
6	2.8	2.8	3.8	3.1	3.2	4.0	2.7	2.8	2.9	3.7	3.5	3.3
7	.....	.....	3.8	3.1	3.2	3.9	2.7	2.8	2.9	3.7	3.5	3.2
8	.....	3.0	3.6	3.1	3.2	3.8	2.7	2.8	3.0	3.6	3.6	3.2
9	2.6	.....	3.4	3.0	3.2	3.6	2.7	2.8	3.0	3.7	3.7	3.2
10	.....	3.1	3.3	3.0	3.1	3.6	2.7	4.3	3.0	3.7	3.8	3.4
11	2.3	.....	3.3	3.0	3.0	3.4	2.7	3.8	2.9	3.7	3.8	3.8
12	.....	3.3	3.3	3.0	3.0	3.3	2.7	3.9	2.9	3.7	3.9	4.0
13	.....	3.4	3.3	3.1	3.0	3.3	2.6	4.1	3.2	3.8	3.6	4.2
14	2.4	5.9	3.3	3.2	3.0	3.2	2.6	3.7	3.1	3.8	3.1	4.3
15	.....	5.7	3.2	3.2	3.2	3.2	2.6	3.8	3.0	3.8	3.2	4.2

Daily gage height, in feet, of Cedar River at Cedar Rapids, Iowa, for 1909–1911—Contd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
16	2.6	6.8	3.2	3.2	3.2	3.1	2.6	4.0	3.0	3.8	3.3	4.2
17	.....	6.2	3.2	3.2	3.3	3.1	2.6	4.3	3.1	4.0	3.4	4.2
18	.....	6.6	3.2	3.2	3.3	3.1	2.6	4.9	3.5	4.3	3.4	4.0
19	2.4	5.2	3.1	3.2	3.3	3.1	2.6	5.0	3.3	4.8	3.8	3.8
20	.....	4.9	3.1	3.2	3.3	3.0	2.6	4.4	3.2	4.6	3.3	3.6
21	.....	4.6	3.1	3.2	3.9	3.0	2.6	3.9	3.2	5.1	3.3	3.5
22	.....	4.2	3.1	3.1	3.8	3.0	2.6	3.7	3.2	5.8	3.2	3.4
23	2.5	4.0	3.1	3.1	3.8	3.0	2.6	3.5	3.3	4.7	3.2	3.4
24	.....	4.1	3.0	3.0	3.1	3.0	2.5	3.4	3.3	4.4	3.2	3.5
25	2.7	4.1	3.0	3.0	4.3	3.0	2.5	3.3	3.2	4.1	3.2	3.6
26	.....	4.2	3.0	2.9	4.2	2.9	2.5	3.2	3.1	4.0	3.1	3.8
27	2.9	4.1	3.1	2.9	4.1	2.9	2.5	3.2	3.2	3.9	3.1	3.7
28	.....	4.0	3.0	2.9	2.9	2.9	2.5	3.1	3.2	3.8	3.1	3.5
29	2.6	.....	3.0	3.1	2.8	2.8	2.7	3.1	3.4	3.7	3.1	3.4
30	.....	.....	3.0	3.0	2.7	2.8	2.8	3.1	3.6	3.7	3.1	3.4
31	2.4	.....	3.0	.....	2.5	.....	2.8	3.0	.....	3.7	.....	3.4

NOTE.—Daily gage height January, February, and March, 1909, published in Water-Supply Paper 265, p. 171. Gage heights from Mar. 14, 1910, to July 31, 1911, as published above, are 1.0 foot greater than reported by the observer. See discussion under "Accuracy" in station description. On days of missing gage height during January, February, March, and December observer reported "Frozen." Relation of gage height to discharge probably affected by ice about Dec. 16, 1909, to Mar. 4, 1910, and Dec. 4, 1910, to Feb. 11, 1911.

Daily discharge, in second-feet, of Cedar River at Cedar Rapids, Iowa, for 1909–1911.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1909.											
1	.....	.....	14,600	11,200	3,790	9,340	1,630	1,630	1,260	810	12,700
2	.....	.....	13,100	12,000	4,430	8,610	1,630	1,440	1,260	1,100	15,400
3	.....	.....	10,800	13,100	4,760	7,530	1,440	1,440	1,100	1,260	14,600
4	.....	.....	10,800	11,200	5,090	7,170	1,260	1,440	1,100	1,260	12,300
5	.....	.....	10,400	9,340	5,090	6,470	1,260	1,260	1,100	1,440	10,800
6	.....	.....	10,800	8,250	5,770	6,120	1,260	1,260	1,100	1,440	11,600
7	.....	.....	10,800	7,530	5,770	5,430	1,260	1,260	950	1,630	9,340
8	.....	.....	10,100	6,820	6,120	5,090	1,260	1,260	950	1,630	7,890
9	.....	.....	9,340	6,120	7,170	4,430	1,260	1,260	950	1,840	7,530
10	.....	.....	8,970	5,430	7,890	4,430	1,260	1,260	950	1,840	15,800
11	.....	.....	8,610	4,760	7,890	4,430	1,440	1,260	950	1,840	19,000
12	.....	.....	7,890	4,430	7,530	4,110	1,440	1,440	950	1,840	19,000
13	.....	.....	7,530	4,110	7,170	4,430	1,630	1,440	950	2,070	17,000
14	.....	.....	7,530	3,790	6,470	4,430	1,630	1,630	950	2,590	15,400
15	.....	.....	7,890	8,250	5,430	4,110	1,630	1,630	1,100	2,590	9,710
16	.....	.....	8,250	12,700	5,090	3,790	2,070	1,630	1,100	6,120	.....
17	.....	.....	7,890	7,170	4,430	3,480	2,590	2,070	950	8,610	.....
18	.....	.....	8,610	7,890	4,110	3,170	3,790	2,590	950	12,000	.....
19	.....	.....	9,340	8,610	4,110	2,870	4,430	2,870	1,100	16,200	.....
20	.....	.....	10,400	8,250	4,110	2,590	5,090	2,590	1,260	17,400	.....
21	.....	.....	13,500	7,530	3,790	2,590	3,790	2,070	1,260	12,700	.....
22	.....	.....	15,400	6,820	3,790	2,320	3,480	2,070	1,260	10,800	.....
23	.....	.....	13,100	6,120	3,790	2,320	3,170	1,840	1,100	8,610	.....
24	.....	.....	11,200	5,090	3,790	2,070	2,590	1,630	1,100	8,970	.....
25	.....	.....	9,710	5,090	4,760	2,070	2,320	1,630	1,100	8,970	.....
26	.....	.....	8,970	4,430	5,770	2,070	2,070	1,630	950	8,250	.....
27	.....	.....	8,970	4,110	7,890	2,070	2,070	1,440	950	8,250	.....
28	.....	.....	7,530	3,790	7,170	2,070	1,840	1,260	950	8,610	.....
29	.....	.....	13,500	3,790	7,530	2,070	1,840	1,260	950	9,340	.....
30	.....	.....	11,600	3,790	8,610	1,840	1,630	1,260	950	9,340	.....
31	.....	.....	.....	3,790	.....	1,840	1,630	.....	950	.....	.....
1910.											
1	.....	2,870	4,430	2,590	1,630	1,100	690	690	690	580	.....
2	.....	3,500	4,430	2,320	1,630	1,100	690	690	690	580	.....
3	.....	4,110	4,110	2,070	1,630	1,100	690	690	690	580	.....
4	.....	4,600	4,110	2,070	1,630	1,100	690	690	690	580	.....
5	.....	5,090	4,430	1,840	1,630	950	690	690	690	690	.....

Daily discharge, in second-feet, of Cedar River at Cedar Rapids, Iowa, for 1909–1911—Con.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.											
6	.....	8,970	5,090	1,840	1,440	950	690	690	690	580	.....
7	.....	10,100	4,430	1,840	1,440	950	690	690	690	580	.....
8	.....	9,340	3,790	1,840	1,440	950	580	690	690	580	.....
9	.....	8,250	3,790	1,630	1,440	950	580	690	690	580	.....
10	.....	8,610	3,170	1,630	1,260	950	580	690	690	580	.....
11	.....	9,340	3,170	1,630	1,260	950	490	690	690	690	.....
12	.....	16,200	2,870	1,630	1,260	810	490	690	690	690	.....
13	.....	20,200	2,870	1,630	1,260	810	490	580	690	690	.....
14	.....	23,700	2,870	1,440	1,260	810	490	580	690	690	.....
15	.....	20,200	3,480	1,440	1,260	810	490	580	690	690	.....
16	.....	18,600	3,480	1,400	1,260	810	580	580	580	690	.....
17	.....	17,400	3,170	1,840	1,260	690	580	580	580	690	.....
18	.....	15,800	2,870	2,070	1,100	690	690	690	580	690	.....
19	.....	14,300	2,590	2,070	1,100	690	690	690	580	690	.....
20	.....	12,000	2,590	2,070	1,100	690	690	690	580	690	.....
21	.....	10,100	2,590	2,070	1,100	690	1,100	690	580	580	.....
22	.....	8,610	2,590	2,070	1,100	690	950	690	580	580	.....
23	.....	8,970	2,320	2,320	1,100	690	810	690	690	580	.....
24	.....	8,250	2,320	2,320	1,100	690	810	810	690	580	.....
25	.....	7,890	2,590	2,590	950	690	690	1,630	690	580	.....
26	.....	7,530	2,590	2,320	950	690	690	1,440	580	580	.....
27	.....	6,820	2,320	2,070	950	690	690	1,260	580	580	.....
28	.....	6,120	2,320	1,840	1,100	690	810	950	580	580	.....
29	.....	5,770	2,320	1,840	1,100	690	810	810	580	580	.....
30	.....	5,090	2,590	1,630	1,100	690	690	810	580	690	.....
31	.....	4,760	.....	1,630	.....	690	690	.....	580	.....	.....
1911.											
1	450	2,590	950	1,100	2,070	690	810	950	8,250	2,070	1,100
2	580	2,320	950	1,100	2,070	690	690	950	5,090	2,070	1,100
3	600	2,320	950	1,100	3,480	690	810	950	3,480	1,840	1,260
4	690	2,590	1,100	1,100	4,110	580	810	950	2,870	1,840	1,100
5	690	2,870	1,100	1,100	3,480	580	690	810	2,590	1,840	1,260
6	690	2,590	1,100	1,260	3,170	580	690	810	2,320	1,840	1,440
7	800	2,590	1,100	1,260	2,870	580	690	810	2,320	1,840	1,260
8	950	2,070	1,100	1,260	2,590	580	690	950	2,070	2,070	1,260
9	1,000	1,630	950	1,260	2,070	580	690	950	2,320	2,320	1,260
10	1,100	1,440	950	1,100	2,070	580	4,110	950	2,320	2,590	1,630
11	1,200	1,440	950	950	1,630	580	2,590	810	2,320	2,590	2,590
12	1,440	1,440	950	950	1,440	580	2,870	810	2,320	2,870	3,170
13	1,630	1,440	1,100	950	1,440	490	3,480	1,260	2,590	2,070	3,790
14	9,710	1,440	1,260	950	1,260	490	2,320	1,100	2,590	1,100	4,110
15	8,970	1,260	1,260	1,260	1,260	490	2,590	950	2,590	1,260	3,790
16	13,100	1,260	1,260	1,260	1,100	490	3,170	950	2,590	1,440	3,790
17	10,800	1,260	1,260	1,440	1,100	490	4,110	1,100	3,170	1,630	3,790
18	12,300	1,260	1,260	1,440	1,100	490	6,120	1,840	4,110	1,630	3,170
19	7,170	1,100	1,260	1,440	1,100	490	6,470	1,440	5,770	2,590	2,590
20	6,120	1,100	1,260	1,440	950	490	4,430	1,260	5,090	1,440	2,070
21	5,090	1,100	1,260	2,870	950	490	2,870	1,260	6,820	1,440	1,840
22	3,790	1,100	1,100	2,590	950	490	2,320	1,260	9,340	1,260	1,630
23	3,170	1,100	1,100	2,590	950	490	1,840	1,440	5,430	1,260	1,630
24	3,480	950	950	1,100	950	410	1,630	1,440	4,430	1,260	1,840
25	3,480	950	950	4,110	950	410	1,440	1,260	3,480	1,260	2,070
26	3,790	950	810	3,790	810	410	1,260	1,100	3,170	1,100	2,590
27	3,480	1,100	810	3,480	810	410	1,260	1,260	2,870	1,100	2,320
28	3,170	950	810	2,870	810	410	1,100	1,260	2,590	1,100	1,840
29	.....	950	1,100	2,590	690	580	1,100	1,630	2,320	1,100	1,630
30	.....	950	950	2,320	690	690	1,100	2,070	2,320	1,100	1,630
31	.....	950	.....	1,840	.....	690	950	.....	2,320	.....	1,630

NOTE.—Daily discharge January, February, and March, 1909, published in Water-Supply Paper 265, page 171. Daily discharge Mar. 14, 1910, to July 31, 1911, computed from corrected gage heights. See discussion under "Accuracy" in station description. Daily discharge May 28 to 31, 1911, corresponds to gage heights 1.0 foot higher than published above, because of apparent additional error in gage heights. Discharge Dec. 16, 1909, to Feb. 28, 1910; Mar. 2 and 4, 1910; Dec. 1, 1910, to Jan. 31, 1911; and Feb. 1, 3, 5, 7, 9, and 11, 1911, estimated because of ice. Mean discharge Dec. 16 to 31, 1909, estimated 5,000 second-feet.

Monthly discharge of Cedar River at Cedar Rapids, Iowa, for 1909–1911.

[Drainage area, 6,320 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
1909.						
January	9,300	840	1,660	0.263	0.30	B.
February	7,020	2,300	4,850	.767	.80	B.
March	21,000	4,290	8,780	1.39	1.60	B.
April	15,400	7,530	10,200	1.61	1.80	C.
May	13,100	3,790	6,950	1.10	1.27	C.
June	8,610	3,790	5,640	.892	1.00	C.
July	9,340	1,840	3,900	.617	.71	C.
August	5,090	1,260	2,120	.335	.39	C.
September	2,870	1,260	1,620	.256	.29	C.
October	1,260	950	1,050	.166	.19	C.
November	17,400	810	5,980	.946	1.06	C.
December	19,000	.....	[a] 8,970	1.42	1.64	D.
The year	21,000	810	5,140	.813	11.05	
1910.						
January	.....	.....	[b] 2,500	.396	.46	D.
February	.....	.....	[b] 2,000	.316	.33	D.
March	23,700	2,870	10,100	1.60	1.84	(c)
April	4,430	2,320	3,210	.508	.57	(c)
May	2,590	1,440	1,920	.304	.35	(c)
June	1,630	950	1,260	.199	.22	(c)
July	1,100	690	821	.130	.15	(c)
August	1,100	490	677	.107	.12	(c)
September	1,630	580	768	.122	.14	(c)
October	690	580	644	.102	.12	(c)
November	690	580	624	.099	.11	(c)
December	.....	.....	[b] 550	.087	.10	(c)
The year	23,700	.....	2,100	.332	4.51	
1911.						
January	.....	.....	[b] 400	.063	.07	(c)
February	13,100	[b] 450	3,910	.619	.64	(c)
March	2,870	950	1,520	.241	.28	(c)
April	1,260	810	1,060	.168	.19	(c)
May	4,110	950	1,740	.275	.32	(c)
June	4,110	690	1,630	.258	.29	(c)
July	690	410	538	.085	.10	(c)
August	6,470	690	2,120	.335	.39	B.
September	2,070	810	1,150	.182	.20	B.
October	9,340	2,070	3,610	.571	.66	B.
November	2,870	1,100	1,700	.269	.30	B.
December	4,110	1,100	2,130	.337	.39	C.
The year	13,100	410	1,780	.282	3.83	

[a] Partly estimated. See footnotes to table of daily discharge.
[b] Estimated.
[c] See station description for discussion of accuracy.

NOTE.—Monthly discharge January, February, and March, 1909, same as published in Water-Supply Paper 265, p. 171. The open-channel rating was applied during the period, the relation of gage height to discharge probably affected only slightly by ice.

DES MOINES RIVER AT JACKSON, MINN.

Location.—At highway bridge half a mile below the dam in Jackson, 100 yards above the nearest tributary, a small stream entering from the west.

Records available.—May 31, 1909, to November 30, 1911.

Drainage area.—1,160 square miles.

Gage.—Vertical staff; datum unchanged since established.

Channel.—Practically permanent.

Discharge measurements.—Made from the bridge.

Winter flow.—Observations are discontinued from December to March because of ice.

Regulation.—At the dam half a mile above the station is a power plant which develops 35 horsepower under a head of 6½ feet. The plant operates only six hours a day on the average, but so far the morning and evening gage heights do not show any appreciable change in the stage of the river owing to water being held back in the low-water season after the turbines have been shut down.

The following discharge measurement was made by C. J. Emerson:
May 3, 1911: Gage height, 2.92 feet; discharge, 39.4 second-feet.

Daily gage height, in feet, of Des Moines River at Jackson, Minn., for 1911.

[Albert Strobel, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.02	2.99	2.75	2.40	2.50	2.80	2.95	3.46	.....
2	.....	2.94	2.92	2.89	2.40	2.68	2.79	2.95	3.29	.....
3	.....	2.91	2.84	2.80	2.42	2.66	2.78	2.96	3.34	.....
4	.....	2.85	2.79	2.74	2.45	2.58	2.70	3.00	3.26	.....
5	.....	2.98	2.69	2.71	2.45	2.60	2.88	3.21	3.25	.....
6	.....	2.96	2.82	2.60	2.42	2.66	3.00	4.51	3.31	.....
7	.....	2.98	2.79	2.60	2.41	3.12	3.05	4.30	3.41	.....
8	.....	2.99	2.80	2.60	2.44	2.99	3.01	4.44	3.36	.....
9	.....	2.98	2.80	2.59	2.40	2.82	2.94	4.25	3.36	.....
10	.....	3.04	2.70	2.58	2.36	3.65	2.92	4.18	3.38	3.40
11	.....	2.84	2.66	2.54	2.35	3.21	2.96	4.20	3.42	3.30
12	.....	2.80	2.65	2.52	2.35	2.99	2.94	4.18	3.65	3.18
13	3.00	2.85	2.65	2.50	2.38	2.98	2.92	4.15	3.32	3.18
14	3.05	2.92	2.65	2.48	2.38	3.15	2.89	4.09	3.12	3.16
15	3.20	3.01	2.66	2.45	2.36	3.10	2.84	4.02	3.08	3.14
16	3.02	2.96	2.68	2.44	2.35	2.94	2.86	3.99	3.02	3.24
17	3.09	3.02	2.70	2.46	2.35	3.08	2.95	4.11	3.11	3.21
18	2.99	2.86	2.72	2.40	2.36	3.02	3.32	4.05	3.05	3.40
19	3.08	2.84	2.79	2.40	2.75	3.18	3.40	4.01	3.00	3.16
20	3.05	3.02	2.66	2.40	2.65	2.96	3.55	4.00	3.01	3.12
21	3.08	3.02	2.65	2.40	2.72	2.91	3.48	3.92	3.02	3.11
22	3.08	2.99	2.68	2.40	2.68	2.88	3.32	3.90	3.05	3.10
23	2.96	2.86	2.71	2.40	2.61	2.86	3.18	3.79	3.54	3.39
24	2.91	2.90	2.88	2.40	2.51	2.88	3.05	3.90	3.42	3.25
25	2.89	2.84	2.90	2.42	2.50	2.85	3.01	3.72	3.12	3.25
26	2.90	2.70	2.79	2.49	2.56	2.95	3.00	3.69	3.09	.....
27	2.91	2.69	2.72	2.48	2.55	2.90	3.06	3.66	3.00	.....
28	2.88	2.68	2.71	2.48	2.49	2.82	3.00	3.60	.....	.....
29	2.80	2.81	2.70	2.48	2.49	2.80	2.96	3.55	.....	.....
30	2.82	2.75	2.68	2.41	2.48	2.80	2.96	3.40	.....	.....
31	2.95	.....	2.69	.....	2.49	2.79	.....	3.52	.....	.....

NOTE.—Ice present about Jan. 1 to Mar. 12, Nov. 28 to Dec. 9, and Dec. 23 to 31, 1911.

Daily discharge, in second-feet, of Des Moines River at Jackson, Minn., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	48	46	34	20	23	36	44	90	.....
2	.....	43	42	40	20	30	36	44	70	.....
3	.....	42	38	36	21	29	35	45	75	.....
4	.....	38	36	33	22	26	31	47	67	.....
5	.....	46	31	32	22	27	40	63	66	.....
6	.....	45	37	27	21	29	47	267	72	.....
7	.....	46	36	27	20	56	50	226	83	.....
8	.....	46	36	27	21	46	48	253	78	.....
9	.....	46	36	27	20	37	43	216	78	.....
10	.....	50	31	26	19	116	42	207	80	82
11	.....	38	29	25	18	63	45	207	85	71
12	.....	36	29	24	18	46	43	207	116	60
13	47	38	29	23	19	46	42	198	73	60
14	50	42	29	22	19	58	40	189	56	59
15	62	48	29	22	19	54	38	172	53	57

Daily discharge, in second-feet, of Des Moines River at Jackson, Minn., for 1911—Con.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	48	45	30	21	18	43	39	172	48	66
17	53	48	31	22	18	53	44	189	55	63
18	46	39	32	20	19	48	73	180	50	82
19	53	38	36	20	34	60	82	172	47	59
20	50	48	29	20	29	45	102	172	48	56
21	53	48	29	20	32	42	92	155	48	55
22	53	46	30	20	30	40	73	155	50	54
23	45	39	32	20	27	39	60	139	102	.....
24	42	41	40	20	23	40	50	155	85	.....
25	40	38	41	21	23	38	48	124	56	.....
26	41	31	36	23	25	44	47	124	53	.....
27	42	31	32	22	25	41	51	116	47	.....
28	40	30	32	22	23	37	47	109	.....	.....
29	36	36	31	22	23	36	45	102	.....	.....
30	37	34	30	20	22	36	45	82	.....	.....
31	44	.....	31	.....	23	36	.....	98	.....	.....

NOTE.—Daily discharge computed from a well-defined rating curve. Discharge Nov. 28 to Dec. 9 and Dec. 23 to 31 estimated, because of ice, from climatologic records and discharge of adjacent drainage areas. Mean discharge Nov. 28 to Dec. 9, estimated 40 second-feet, varying from about 35 to 55 second-feet. Mean discharge Dec. 23 to 31, estimated 50 second-feet, varying from about 30 to 70 second-feet.

Monthly discharge of Des Moines River at Jackson, Minn., for 1911.

[Drainage area, 1,160 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
March 13-31	62	36	46.4	0.040	0.03	A.
April	50	30	41.5	.036	.04	A.
May	46	29	33.4	.029	.03	A.
June	40	20	24.6	.021	.02	A.
July	34	18	22.4	.019	.02	A.
August	116	23	44.0	.038	.04	A.
September	102	31	50.5	.044	.05	A.
October	267	44	149	.128	.15	A.
November	116	35	64.7	.056	.06	B.
December	82	.....	53.0	.046	.05	C.

NOTE.—See footnotes to table of daily discharge.

DES MOINES RIVER NEAR FORT DODGE, IOWA.

Location.—At the upper highway bridge 1 mile upstream from Fort Dodge and just above the Illinois Central Railroad bridge, about 1 mile above the old "Swede Town" bridge at which the station was maintained during 1905-6. The original bridge has been torn down and the new structure, about 15 feet higher, which has been put in its place was found to be unsuited for a gaging station.

Records available.—April 23, 1905, to July 19, 1906; August 4, 1911, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Chain, fastened to the outside handrail, downstream side of right span; datum unchanged.

Channel.—Bed composed of sand and gravel; considered practically permanent. One channel at all stages, broken only by the bridge pier.

Winter flow.—Ice may affect the relation of gage height to discharge during December, January, and February.

Accuracy.—The relation between gage height and discharge may at times be affected by backwater from Lizard Creek if heavy rains occur in the basin of that stream.

On August 4, 1911, at a gage height of 0.80 foot, Follansbee and Kay estimated the discharge as 29 second-feet, stating that a current-meter measurement was not possible because of low velocity.

Daily gage height, in feet, of Des Moines River near Fort Dodge, Iowa, for 1911.

[Ole C. Hanson, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.00	1.50	1.65	1.60	16	1.22	1.18	1.70	1.55	1.68
2	.....	1.10	1.50	1.80	1.60	17	1.00	1.22	1.75	1.50	1.70
3	.....	1.00	1.55	1.75	1.60	18	1.10	1.22	1.75	1.50	1.70
4	.80	1.10	1.50	1.70	1.60	19	1.25	1.20	1.70	1.55	1.72
5	.90	1.00	1.45	1.65	1.58	20	1.22	1.20	1.70	1.58	1.70
6	.90	1.18	1.45	1.60	1.55	21	1.25	1.25	1.70	1.60	1.70
7	.98	1.25	1.50	1.62	1.50	22	1.28	1.20	1.65	1.60	1.70
8	1.00	1.20	1.45	1.60	1.50	23	1.20	1.20	1.70	1.60	1.70
9	.95	1.20	1.40	1.60	1.50	24	1.18	1.20	1.70	1.60	1.70
10	1.02	1.60	1.45	1.55	1.50	25	1.18	1.25	1.70	1.60	1.68
11	1.05	1.40	1.45	1.60	1.75	26	1.20	1.25	1.68	1.60	1.65
12	1.10	1.25	1.60	1.55	1.80	27	1.15	1.20	1.70	1.60	1.62
13	1.05	1.95	1.65	1.60	1.78	28	1.20	1.20	1.70	1.60	1.60
14	1.10	1.40	1.70	1.60	1.75	29	1.10	1.22	1.70	1.58	1.60
15	1.10	1.30	1.75	1.60	1.70	30	1.22	1.25	1.65	1.60	1.60
						31	1.20	.....	1.65	.....	1.60

DES MOINES RIVER AT KEOSAUQUA, IOWA.

Location.—At county bridge one-fourth mile above old dam site and Government locks.

Records available.—May 30, 1903, to July 16, 1906; April 5, 1910, to December 31, 1910 (Army Engineers); August 3, 1911, to December 23, 1911.

Drainage area.—14,300 square miles.

Gage.—Chain gage attached to downstream side of bridge; same gage used throughout period of records. On August 3, 1911, a possible discrepancy of 0.20 or 0.26 foot was found, by levels, in the gage as referred to the original bench marks.

Channel.—Composed of sand and gravel on the left and rock on the right. Shifting of the sand occurs at flood stages.

Discharge measurements.—Made from the downstream side of the bridge.

Winter flow.—Relation of gage height to discharge is sometimes affected by ice.

Accuracy.—Gage heights and estimates of discharge for 1910 and 1911 are being withheld from publication until sufficient data are collected to eliminate the possible errors noted under "Gage."

Discharge measurements of Des Moines River at Keosauqua, Iowa, in 1910–11.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
1910. Aug. 4 [a]	A. D. Llewellyn	0.5	719
1911. Aug. 3	Follansbee and Kay	.10	266

[a] Measurement furnished by U. S. Army Engineers.

NOTE.—The gage heights above may be from 0.20 to 0.26 foot too low when referred to the original gage datum. See "Accuracy" paragraph in station description.

ILLINOIS RIVER BASIN.

SANGAMON RIVER NEAR MONTICELLO, ILL.

Location.—At Illinois Central Railroad bridge about half a mile west of Monticello, Ill.

Records available.—February 4, 1908, to December 31, 1911.

Drainage area.—550 square miles.

Gage.—Standard chain gage attached to bridge; datum unchanged.

Channel.—Section is at a pool; measurements to date indicate that control is permanent.

Discharge measurements.—Made from downstream side of bridge and wooden trestle approach.

Floods.—The flood of May, 1908, reached a height of 15.2 feet on the gage.

Winter flow.—Ice affects the relation between gage height and discharge during portions of December, January, and February.

The following discharge measurement was made by Monk and Brown:
October 11, 1911: Gage height, 5.22 feet; discharge, 356 second-feet.

Daily gage height, in feet, of Sangamon River near Monticello, Ill., for 1911.

[Martin Doyle, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	6.74	4.08	3.82	5.68	3.18	1.90	1.87	1.76	.....	4.38	6.21
2	3.75	6.00	4.00	.....	5.70	3.15	.....	1.78	1.70	8.83	4.22	6.10
3	[a] 3.7	5.45	3.95	3.68	5.55	2.90	1.90	1.77	.....	8.97	4.03	.....
4	[a] 3.45	5.18	3.85	4.15	5.23	.....	1.89	1.73	1.66	9.16	3.95	5.52
5	[a] 3.3	.....	.....	6.20	5.00	2.75	1.86	1.68	1.67	8.96	.....	5.30
6	[a] 3.05	4.65	3.65	7.90	4.72	2.68	1.81	.....	1.67	8.23	4.08	5.08
7	[a] 2.9	4.15	4.32	7.98	.....	2.68	1.78	1.69	1.78	7.43	4.15	5.00
8	.....	4.00	5.31	7.28	4.40	2.55	1.78	1.69	1.76	.....	4.25	4.92
9	[a] 2.7	4.00	6.60	.....	4.39	2.47	.....	1.68	2.14	6.07	4.37	4.86
10	[a] 2.6	3.55	7.20	5.85	4.25	2.40	2.30	1.68	.....	5.63	4.30	.....
11	[a] 2.7	3.31	6.55	5.45	4.80	.....	2.14	1.68	2.78	5.29	4.30	5.10
12	2.79	.....	.....	5.33	3.98	2.28	2.02	1.66	4.68	5.02	.....	5.34
13	3.25	3.84	5.64	5.38	3.81	2.24	1.96	.....	4.68	4.78	8.48	5.41
14	9.8	4.00	5.38	7.60	.....	2.20	1.84	1.61	3.73	4.58	8.88	5.32
15	.....	4.80	5.29	9.60	3.51	2.18	.....	1.60	3.37	.....	8.51	5.22
16	9.70	6.41	4.95	10.10	3.51	2.12	1.94	1.60	4.39	4.31	7.59	5.20
17	10.05	6.38	4.61	9.88	3.45	2.10	1.88	1.60	.....	4.48	8.34	.....
18	[a] 7.95	6.00	4.60	8.61	3.40	.....	1.84	1.60	4.73	4.81	9.95	4.82
19	[a] 7.2	.....	.....	7.80	3.35	2.01	1.79	1.58	4.23	4.61	10.15	4.68
20	[a] 6.75	6.40	4.21	7.30	3.30	2.08	1.79	.....	4.48	4.28	10.20	4.62
21	[a] 6.7	.....	4.00	7.30	.....	2.12	1.78	1.58	4.58	4.18	9.33	5.01
22	.....	4.95	4.00	7.30	3.41	2.08	.....	1.58	3.88	.....	8.60	6.50
23	[a] 4.9	4.75	3.98	.....	3.38	2.01	.....	1.71	3.40	5.89	8.05	7.90
24	[a] 4.5	5.00	3.72	6.20	3.22	2.04	1.84	1.93	.....	6.75	7.50	.....
25	4.71	4.61	3.60	5.81	3.15	.....	1.78	1.87	5.47	6.12	7.02	8.29
26	6.69	4.40	.....	5.55	3.02	2.18	1.77	1.86	8.63	5.68	.....	7.56
27	8.07	4.40	3.85	5.32	2.99	2.29	1.77	.....	9.10	5.26	6.38	7.55
28	9.95	4.23	4.05	5.32	.....	2.18	1.71	2.21	9.46	4.94	6.30	7.38
29	9.88	.....	4.23	5.40	2.89	2.08	1.78	1.80	9.56	.....	6.35	7.00
30	9.32	.....	4.08	.....	2.88	1.90	.....	1.78	8.83	4.56	6.42	7.29
31	8.02	.....	4.00	.....	2.98	.....	1.76	1.76	.....	4.50	.....	.....

[a] Gage read to top of ice Jan. 3 to 11 and Jan. 18 to 24. Ice 6 to 8 inches in thickness on Jan. 9.

NOTE.—Gage not read on Sunday. Relation of gage height to discharge affected by ice about Jan. 1 to 29.

Daily discharge, in second-feet, of Sangamon River near Monticello, Ill., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	646	180	150	444	88	8	7.4	5.2	1,180	219	545
2	.....	505	170	143	448	86	8	5.6	4	1,180	197	524
3	.....	401	164	136	420	66	8	5.4	4	1,230	174	469
4	.....	352	154	188	361	60	7.8	4.6	3.2	1,310	164	414
5	.....	306	144	543	320	54	7.2	3.6	3.4	1,230	172	374
6	.....	260	133	895	271	49	6.2	3.7	3.4	985	180	334
7	.....	188	211	915	246	49	5.6	3.8	5.6	784	188	320
8	.....	170	376	752	222	40	5.6	3.8	5.2	651	201	306
9	.....	170	619	614	221	35	4	3.6	17	518	218	295
10	.....	123	735	476	201	31	25	3.6	40	435	208	316
11	.....	100	610	401	284	27	17	3.6	56	356	268	338
12	.....	126	524	379	168	24	12	3.2	265	324	634	381
13	.....	152	437	388	149	22	10	2.7	265	281	1,060	394
14	.....	170	388	822	134	20	6.8	2.2	141	249	1,200	378
15	.....	284	372	1,580	119	19	8	2	105	236	1,070	360
16	.....	583	311	2,020	119	16	9.2	2	221	222	820	356
17	.....	577	254	1,810	113	15	7.6	2	250	233	1,020	322
18	.....	505	252	1,100	108	13	6.8	2	273	286	1,880	288
19	.....	548	224	870	104	11	5.8	1.6	198	254	2,070	265
20	.....	581	195	756	99	14	5.8	1.6	233	205	2,120	255
21	.....	446	170	756	125	16	5.6	1.6	249	192	1,410	322
22	.....	311	170	756	109	14	6.0	1.6	157	338	1,100	600
23	.....	276	168	650	106	11	6.4	4.2	108	484	934	895
24	.....	320	140	543	92	13	6.8	8.9	100	648	799	948
25	.....	254	128	469	86	16	5.6	7.4	405	528	699	1,000
26	.....	222	150	420	76	19	5.4	7.2	1,110	444	638	813
27	.....	222	154	378	73	24	5.4	15	1,280	367	577	810
28	.....	198	176	378	66	19	4.2	20	1,490	309	562	773
29	.....	.....	198	392	65	14	5.6	6	1,550	278	572	695
30	1,390	.....	180	400	64	8	5.5	5.6	1,180	246	585	754
31	926	.....	170	.....	72	.....	5.2	5.2	.....	236	.....	658

NOTE.—Daily discharge determined by means of a discharge rating curve well defined between 11 and 1,390 second-feet (gage heights 2 and 9.3 feet); fairly well defined between 1,450 and 7,360 second-feet (gage heights 9.4 and 14 feet). Above gage height 12.6 feet the curve was extended as a tangent. Daily discharge interpolated on days when gage was not read. Daily discharge Jan. 1 to 29 estimated, because of ice, from observer's notes, climatologic records, and discharge at Riverton, Ill. Mean discharge Jan. 1 to 29 estimated about 508 second-feet, varying from about 20 to 1,740 second-feet.

Monthly discharge of Sangamon River near Monticello, Ill., for 1911.

[Drainage area, 550 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January [a]	.....	.....	550	1.00	1.15	B.
February	646	100	321	.584	.61	A.
March	735	128	266	.484	.56	A.
April	2,020	136	669	1.22	1.36	B.
May	448	64	177	.322	.37	A.
June	88	8	29.8	.054	.06	B.
July	25	4	7.62	.014	.02	C.
August	20	1.6	4.86	.0088	.01	C.
September	1,550	3.2	324	.589	.66	A.
October	1,310	192	523	.951	1.10	A.
November	2,120	164	729	1.33	1.48	B.
December	1,000	255	500	.909	1.05	A.
The year	2,120	1.6	341	.620	8.43	

[a] For notes relative to estimated discharge during January see footnotes to table of daily discharge.

SANGAMON RIVER AT RIVERTON, ILL.

Location.—At Wabash Railroad bridge about a quarter of a mile west of depot at Riverton, Ill., about 2½ miles below the mouth of South Fork.

Records available.—February 13, 1908, to December 31, 1911.

Drainage area.—2,560 square miles.

Gage.—Standard chain gage attached to bridge; datum unchanged.

Channel.—Slightly shifting; section is at a pool and measurements to date indicate that the point of control is not changing; broken by two bridge piers.

Discharge measurements.—Made from downstream side of three-span bridge.

Floods.—The high water of 1883 reached a height of approximately 32 feet on the present gage. The high water of 1875 is said to have been one-half foot lower than this. The high water of October, 1911, reached a height of 27.1 feet.

Winter flow.—Ice may affect the relation between gage height and discharge during short periods of extremely cold weather—December, January, and February—in the milder weather the formation of ice is prevented by warm water wasted from the factories.

Discharge measurements of Sangamon River at Riverton, Ill., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 20	P. S. Monk	11.80	1,180
Oct. 5	Monk and Brown	25.36	15,400

Daily gage height, in feet, of Sangamon River at Riverton, Ill., in 1911.

[J. H. Steele, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	14.5	17.7	13.45	10.9	14.4	10.0	9.3	7.4	7.8	27.1	12.3	14.3
2	14.1	17.65	13.1	10.7	16.0	9.8	8.7	7.35	7.6	26.6	12.1	14.2
3	13.5	17.4	12.55	10.9	16.1	9.6	8.4	7.3	7.4	26.5	11.9	14.1
4	12.1	16.65	12.25	13.0	16.0	9.4	8.1	7.3	7.3	26.4	11.6	13.9
5	11.6	14.9	11.85	15.9	15.8	9.3	8.0	7.2	7.2	25.4	11.5	13.6
6	11.3	13.8	11.65	17.9	15.4	9.1	7.9	7.15	7.2	24.8	11.5	13.3
7	11.25	13.25	11.9	18.5	14.4	9.4	7.7	7.1	7.4	23.9	11.8	13.1
8	11.2	12.9	14.25	18.4	13.45	9.0	7.6	8.0	8.2	23.2	12.0	12.9
9	10.8	12.85	15.75	18.2	12.7	8.8	7.5	8.2	10.7	22.6	12.1	12.7
10	10.2	12.5	16.55	17.8	12.3	8.5	7.5	8.4	12.8	21.9	12.1	12.6
11	10.0	12.4	16.75	17.0	12.0	8.5	7.4	8.1	11.0	21.0	12.0	12.8
12	9.9	12.25	15.8	15.6	11.7	8.4	7.4	7.9	10.1	19.6	16.0	13.0
13	9.8	12.0	15.45	14.7	11.5	8.2	7.7	7.6	10.0	17.5	17.4	13.1
14	17.3	11.85	14.75	17.1	11.2	8.2	7.5	7.4	13.2	16.0	17.8	13.1
15	20.5	12.2	13.85	20.3	10.9	8.1	7.3	7.3	13.9	15.0	17.8	13.1
16	21.6	12.35	13.15	20.9	10.7	8.1	7.25	7.2	13.8	14.4	17.7	13.0
17	20.5	12.65	12.7	20.6	10.6	8.0	7.2	7.1	14.4	13.9	17.9	13.0
18	19.5	13.6	12.35	20.5	10.5	8.0	7.1	7.0	14.1	13.6	19.1	12.8
19	18.9	14.45	12.15	20.4	10.3	7.9	7.0	6.9	14.2	13.3	20.2	12.6
20	18.7	15.0	11.85	19.8	10.2	7.85	7.0	6.8	14.5	13.0	20.1	12.6
21	18.9	15.75	11.6	19.0	11.8	7.9	7.0	6.7	14.6	12.8	19.9	13.2
22	17.2	15.55	11.4	17.7	13.4	8.0	7.0	6.7	13.9	12.9	19.5	16.2
23	15.65	15.3	11.2	16.0	12.6	7.9	7.0	6.7	12.8	13.1	19.2	17.4
24	14.0	14.75	11.0	14.8	11.4	7.9	7.0	7.0	11.8	13.4	18.8	17.45
25	13.45	14.3	10.8	14.1	10.8	10 6	7.0	7.55	16.9	13.7	18.4	17.1
26	13.3	13.95	10.7	13.6	10.4	9.5	7.0	7.9	19.7	13.9	17.8	16.8
27	13.9	13.75	10.9	13.1	10.2	9.7	7.0	8.0	19.8	13.9	17.1	17.3
28	16.25	13.6	10.9	12.9	10.0	9.4	6.9	7.9	20.3	13.6	16.1	17.5
29	17.1	.....	10.9	12.9	9.8	9.2	6.9	10.4	23.55	13.1	15.3	18.0
30	17.35	.....	11.0	13.0	9.8	9.4	6.9	9.6	26.4	12.7	14.8	16.4
31	17.5	.....	11.0	.....	10.2	.....	6.85	8.3	.....	12.5	.....	16.0

NOTE.—Relation of gage height to discharge probably not affected by ice during 1911.

Daily discharge, in second-feet, of Sangamon River at Riverton, Ill., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,380	4,190	1,850	888	2,320	603	411	128	168	19,200	1,390	2,260
2	2,160	4,160	1,710	824	3,200	542	287	124	148	18,100	1,310	2,210
3	1,870	4,010	1,480	888	3,260	486	240	119	128	17,800	1,240	2,160
4	1,310	3,580	1,370	1,660	3,200	435	202	119	119	17,600	1,130	2,050
5	1,130	2,600	1,220	3,140	3,090	411	190	110	110	15,300	1,100	1,920
6	1,020	2,000	1,150	4,310	2,870	366	179	106	110	14,000	1,100	1,790
7	1,010	1,770	1,240	4,690	2,320	435	158	101	128	12,100	1,200	1,710
8	990	1,620	2,240	4,620	1,850	344	148	190	214	10,700	1,280	1,620
9	856	1,600	3,060	4,490	1,540	305	138	214	824	9,620	1,310	1,540
10	665	1,460	3,520	4,250	1,390	254	138	240	1,580	8,460	1,310	1,500
11	603	1,420	3,640	3,780	1,280	254	128	202	920	7,180	1,280	1,580
12	572	1,370	3,090	2,980	1,170	240	128	179	634	5,610	3,200	1,660
13	542	1,280	2,900	2,480	1,100	214	158	148	603	4,070	4,010	1,710
14	3,950	1,220	2,510	3,840	990	214	138	128	1,750	3,200	4,250	1,710
15	6,560	1,350	2,030	6,340	888	202	119	119	2,050	2,650	4,250	1,710
16	8,010	1,410	1,730	7,060	824	202	114	110	2,000	2,320	4,190	1,660
17	6,560	1,520	1,540	6,680	792	190	110	101	2,320	2,050	4,310	1,660
18	5,520	1,920	1,410	6,560	760	190	101	92	2,160	1,920	5,160	1,580
19	4,990	2,350	1,330	6,450	696	179	92	83	2,210	1,790	6,220	1,500
20	4,840	2,650	1,220	5,800	665	174	92	75	2,380	1,660	6,120	1,500
21	4,990	3,060	1,130	5,070	1,200	179	92	67	2,430	1,580	5,900	1,750
22	3,900	2,950	1,060	4,190	1,830	190	92	67	2,050	1,620	5,520	3,320
23	3,010	2,820	990	3,200	1,500	179	92	67	1,580	1,710	5,240	4,010
24	2,100	2,510	920	2,540	1,060	179	92	92	1,200	1,830	4,910	4,040
25	1,850	2,260	856	2,160	856	792	92	143	3,720	1,960	4,620	3,840
26	1,790	2,080	824	1,920	728	460	92	179	5,700	2,050	4,250	3,660
27	2,050	1,980	888	1,710	665	513	92	190	5,800	2,050	3,840	3,950
28	3,340	1,920	888	1,620	603	435	83	179	6,340	1,920	3,260	4,070
29	3,840	.....	888	1,620	542	388	83	728	11,400	1,710	2,820	4,370
30	3,980	.....	920	1,660	542	435	83	486	17,600	1,540	2,540	3,430
31	4,070	.....	920	.....	665	.....	79	227	.....	1,460	.....	3,200

NOTE.—Daily discharge determined by means of a discharge rating curve well defined between 138 and 4,370 second-feet (gage heights 7.5 and 18.0 feet). Above 4,370 second-feet (gage height 18.0 feet) the rating curve is based on one discharge measurement at gage height 25.4 feet.

Monthly discharge of Sangamon River at Riverton, Ill., for 1911.

[Drainage area, 2,560 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	8,010	542	2,920	1.14	1.31	B.
February	4,190	1,220	2,250	.879	.92	A.
March	3,640	824	1,630	.637	.73	A.
April	7,060	824	3,580	1.40	1.56	A.
May	3,260	542	1,430	.559	.64	A.
June	792	174	333	.130	.14	B.
July	411	79	137	.054	.06	B.
August	728	67	165	.064	.07	B.
September	17,600	110	2,610	1.02	1.14	A.
October	19,200	1,460	6,280	2.45	2.82	A.
November	6,220	1,100	3,280	1.28	1.43	B.
December	4,370	1,500	2,410	.941	1.09	B.
The year	19,200	67	2,250	.879	11.91	

SANGAMON RIVER NEAR OAKFORD, ILL.

Location.—At highway bridge 3 miles northeast of Oakford, Ill., near the northwest corner of T. 19 N., R. 7 W., 2½ miles above the Chicago, Peoria & St. Louis Railway bridge, and 1¼ miles above the mouth of Crane Creek.

Records available.—October 26, 1909, to June 30, 1911, and December 10 to 31, 1911.

Drainage area.—5,000 square miles.

Gage.—Standard chain gage attached to bridge; datum unchanged.

Channel.—Shifting; the river for some distance above and below the station has been dredged and straightened, thus increasing the slope considerably and disturbing the regimen of the river. Conditions along the improved section are probably reverting to their former natural state. Measurements to date, however, indicate little or no change in the relation between gage height and discharge.

Discharge measurements.—Made from downstream side of bridge and wooden-trestle approaches.

Floods.—The floods of February and March, 1907, May, 1908, and October, 1911, reached a height of about 21 feet on the present gage.

Winter flow.—Ice may affect the relation between gage height and discharge during portions of December, January, and February.

Accuracy.—Backwater caused by ice jams or drift lodging at the railroad trestle 2½ miles below the gaging station may at times affect the relation between gage height and discharge.

Discharge measurements of Sangamon River near Oakford, Ill., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Mar. 21	P. S. Monk	5.95	2,300
Oct. 10	Monk and Brown	16.60	16,400

Daily gage height, in feet, of Sangamon River near Oakford, Ill., for 1911.

[Ed. J. Bonnett, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.9	11.1	6.7	4.9	6.95	4.05						
2	6.5	10.25	6.55	4.8	7.85	3.9						
3	6.5	9.9	6.35	4.9	8.05	3.85						
4	8.6	9.6	6.0	5.25	8.35	3.7				20.6		
5	8.0	9.15	5.8	7.35	8.1	3.6						
6	7.8	8.0	5.7	9.05	7.9	3.55						
7	[a] 7.7	7.3	5.6	9.95	7.8	3.4						
8	[a] 7.5	6.75	6.9	10.35	7.1	3.3						
9	[a] 6.8	6.5	8.4	10.3	6.5	3.15						
10	[a] 6.7	6.2	9.0	10.05	6.1	3.05				16.6		6.9
11	[a] 6.5	6.1	9.2	9.85	5.8	3.0						6.8
12	[a] 5.9	6.0	9.1	9.4	5.55	2.65						6.85
13	7.1	5.95	9.0	9.25	5.35	2.6						6.95
14	9.1	5.9	8.6	9.2	5.15	2.55						7.1
15	10.2	6.0	8.1	9.9	4.9	2.5						7.05
16	11.0	6.85	7.5	11.1	4.7	2.4						7.1
17	12.1	7.0	7.0	12.0	4.55	2.35						7.0
18	12.0	7.2	6.5	12.2	4.45	2.3						7.0
19	11.8	7.5	6.5	12.3	4.35	2.3						6.8
20	11.5	8.0	6.2	12.0	4.25	2.25						6.5
21	11.4	8.6	5.9	11.8	4.2	2.2						6.8
22	10.9	8.55	5.65	11.35	5.85	2.15						8.2
23	10.55	8.25	5.4	10.7	6.5	2.15						10.1
24	9.3	8.1	5.2	9.05	5.8	2.2						11.0
25	8.0	7.9	5.15	8.6	5.45	4.35						11.2
26	8.3	7.4	5.0	7.7	4.8	3.75						11.0
27	9.95	7.1	4.95	7.2	4.5	3.9						10.95
28	11.45	6.9	5.0	7.0	4.25	3.05						10.9
29	12.9		5.0	6.9	4.15	4.2						10.8
30	12.5		5.0	6.9	4.15	3.5						10.65
31	11.6		5.0		4.15							10.3

[a] Jan. 7 to 12, gage heights to top of ice.

NOTE.—Relation of gage height to discharge affected by ice about Jan. 4 to 14. Record lacking July 1 to Dec. 9 because no observer could be obtained.

Daily discharge, in second-feet, of Sangamon River near Oakford, Ill., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,000	6,960	2,840	1,610	3,030	1,170	.....	.....	.....	.....	.....	.....
2	2,700	6,040	2,730	1,560	3,740	1,100	.....	.....	.....	.....	.....	.....
3	2,700	5,680	2,580	1,610	3,900	1,080	.....	.....	.....	.....	.....	.....
4	.....	5,360	2,320	1,820	4,180	1,020	.....	.....	.....	26,300	.....	.....
5	.....	4,910	2,180	3,340	3,950	980	.....	.....	.....	.....	.....	.....
6	.....	3,860	2,110	4,810	3,780	960	.....	.....	.....	.....	.....	.....
7	.....	3,300	2,040	5,730	3,700	900	.....	.....	.....	.....	.....	.....
8	.....	2,880	3,000	6,150	3,140	860	.....	.....	.....	.....	.....	.....
9	.....	2,700	4,220	6,100	2,700	800	.....	.....	.....	.....	.....	.....
10	.....	2,470	4,760	5,830	2,400	760	.....	.....	.....	16,300	.....	3,000
11	.....	2,400	4,960	5,620	2,180	740	.....	.....	.....	.....	.....	2,920
12	.....	2,320	4,860	5,160	2,000	608	.....	.....	.....	.....	.....	2,960
13	.....	2,280	4,760	5,010	1,880	590	.....	.....	.....	.....	.....	3,030
14	.....	2,250	4,400	4,960	1,760	572	.....	.....	.....	.....	.....	3,140
15	5,990	2,320	3,950	5,680	1,610	555	.....	.....	.....	.....	.....	3,110
16	6,850	2,960	3,460	6,960	1,500	520	.....	.....	.....	.....	.....	3,140
17	8,120	3,070	3,070	8,000	1,420	502	.....	.....	.....	.....	.....	3,070
18	8,000	3,220	2,700	8,240	1,360	485	.....	.....	.....	.....	.....	3,070
19	7,700	3,460	2,700	8,360	1,320	485	.....	.....	.....	.....	.....	2,920
20	7,400	3,860	2,470	8,000	1,260	468	.....	.....	.....	.....	.....	2,700
21	7,290	4,400	2,250	7,760	1,240	450	.....	.....	.....	.....	.....	2,920
22	6,740	4,360	2,080	7,240	2,220	432	.....	.....	.....	.....	.....	4,040
23	6,360	4,080	1,910	6,520	2,700	432	.....	.....	.....	.....	.....	5,880
24	5,060	3,950	1,790	4,810	2,180	450	.....	.....	.....	.....	.....	6,850
25	3,860	3,780	1,760	4,400	1,940	1,320	.....	.....	.....	.....	.....	7,070
26	4,130	3,380	1,670	3,620	1,560	1,040	.....	.....	.....	.....	.....	6,850
27	5,730	3,140	1,640	3,220	1,390	1,100	.....	.....	.....	.....	.....	6,800
28	7,340	3,000	1,670	3,070	1,260	760	.....	.....	.....	.....	.....	6,740
29	9,100	.....	1,670	3,000	1,220	1,240	.....	.....	.....	.....	.....	6,630
30	8,600	.....	1,670	3,000	1,220	940	.....	.....	.....	.....	.....	6,460
31	7,520	.....	1,670	.....	1,220	.....	.....	.....	.....	.....	.....	6,100

NOTE.—Daily discharge determined from a discharge rating curve well defined between 380 and 8,000 second-feet (gage heights 2.0 and 12.0 feet). Above 8,000 second feet (gage height 12.0 feet) the rating curve is based on one measurement at gage height 16.6 feet. Above 14,800 second-feet (gage height 16.0 feet) the rating curve is a tangent. Daily discharge Jan. 4 to 14 estimated, because of ice, from climatologic records and discharge at Riverton, Ill. Mean discharge Jan. 4 to 14 estimated about 2,240 second-feet, varying from about 1,400 to 4,000 second-feet.

Monthly discharge of Sangamon River near Oakford, Ill., for 1911.

[Drainage area, 5,000 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	9,100	.....	4,800	0.960	1.11	B.
February	6,960	2,250	3,660	.732	.76	A.
March	4,960	1,640	2,770	.554	.64	A.
April	8,360	1,560	5,040	1.01	1.13	A.
May	4,180	1,220	2,220	.444	.51	A.
June	1,320	432	777	.155	.17	A.
December 10–31	7,070	2,700	4,520	.904	.74	A.

SOUTH FORK OF SANGAMON RIVER NEAR TAYLORVILLE, ILL.

Location.—At the Wabash Railroad bridge about 3½ miles southwest of Taylorville, about one-fourth mile upstream from the highway bridge known as the Half Acre Bridge.

Records available.—February 11, 1908, to December 31, 1911.

Drainage area.—427 square miles.

Gage.—Standard chain gage attached to bridge. On September 2, 1909, the gage datum was lowered 2 feet. The gage heights to August 10, 1909, refer to the

old datum; those from August 11 to September 1, 1909, are of no value because of backwater from a construction dam built and used during that period. From September 2, 1909, to date the gage heights refer to the new datum.

Channel.—In August, 1909, a drainage ditch was dug along the river in this vicinity, straightening the course of the stream, but coinciding with the original channel at the gaging station. The cross section of the channel was not changed at the measuring section, but the relation between gage height and discharge was considerably changed by the change in slope. The channel shifts to some extent, but measurements to date indicate that the point of control is probably permanent.

Discharge measurements.—Made from the downstream side of the bridge.

Floods.—Maximum gage height since establishment of gage, 15.9 feet, occurred in September, 1911. No authentic record of floods prior to the establishment of the station is available.

Winter flow.—Ice may affect the relation between gage height and discharge during portions of December, January, and February.

Discharge measurements of South Fork of Sangamon River near Taylorville, Ill., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Mar. 18	P. S. Monk	5.31	184
Oct. 7	Monk and Brown	10.33	1,360

Daily gage height, in feet, of South Fork of Sangamon River near Taylorville, Ill., for 1911.

[Joseph Ethridge, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	9.15	8.9	7.1	4.55	8.8	3.3	4.3	1.65	1.9	15.55	5.2	5.9
2	8.4	8.25	6.45	4.4	9.75	3.2	2.95	1.7	1.7	14.0	5.0	5.95
3	7.15	7.3	6.25	5.6	10.05	3.1	2.75	1.7	1.65	13.0	4.75	5.7
4	[a] 7.15	6.7	5.9	7.85	9.7	3.0	2.55	1.9	1.6	12.4	4.7	5.55
5	[a] 7.1	6.25	5.6	8.3	8.9	2.85	2.4	1.8	1.65	11.65	4.75	5.45
6	[a] 6.9	6.05	5.35	9.95	7.45	2.8	2.5	1.75	1.65	11.10	4.9	5.3
7	[a] 5.1	6.4	5.65	10.4	6.6	2.85	2.2	1.75	2.85	10.65	5.25	5.3
8	[a] 4.55	6.45	8.25	9.95	6.05	2.7	2.15	1.8	2.95	10.0	5.35	5.25
9	[a] 4.2	6.7	9.4	9.1	5.7	2.7	2.1	1.65	6.10	9.45	5.55	5.3
10	[a] 4.15	6.65	9.45	7.85	5.55	2.65	2.05	2.15	6.7	8.4	5.45	5.4
11	4.2	6.35	9.15	6.95	5.4	2.6	2.0	2.3	5.55	7.85	5.4	5.9
12	4.7	5.85	8.25	6.55	5.15	2.5	1.95	2.9	3.55	7.1	8.1	6.4
13	4.7	5.7	7.25	6.45	4.85	2.45	1.95	2.4	2.95	6.65	9.25	6.45
14	10.2	5.65	6.55	10.15	4.65	2.4	2.0	2.0	6.15	6.2	9.7	6.15
15	13.5	6.0	6.2	11.65	4.45	2.4	1.9	1.8	7.05	6.0	9.8	5.9
16	12.5	6.45	5.8	11.4	4.3	2.4	1.85	1.7	8.35	5.85	9.7	5.9
17	13.55	6.6	5.35	10.5	4.2	2.4	1.8	1.6	9.1	5.6	9.25	5.85
18	10.25	7.5	5.4	9.9	4.15	3.7	1.75	1.6	9.3	5.45	9.2	5.95
19	9.5	8.2	5.3	9.15	4.1	3.6	1.75	1.6	9.1	5.2	9.85	6.15
20	7.9	8.95	5.0	8.15	4.05	2.7	1.8	1.5	8.4	5.1	9.5	6.5
21	6.85	8.85	4.95	7.4	3.95	2.5	1.8	1.55	7.05	5.05	9.4	7.0
22	7.15	8.55	4.7	6.8	5.0	2.4	1.75	1.5	5.6	5.35	8.95	9.85
23	7.1	8.15	4.55	5.95	4.4	2.3	1.75	1.5	4.75	6.45	8.15	9.9
24	5.9	7.55	4.4	5.2	3.95	2.5	1.75	2.4	4.15	6.35	7.35	9.85
25	5.45	7.4	4.3	5.55	3.7	2.5	1.85	3.15	4.8	7.4	6.75	8.3
26	5.9	7.7	4.3	5.4	3.55	5.2	1.8	3.6	7.8	6.8	6.35	7.5
27	7.8	8.45	4.7	5.25	3.45	5.8	1.7	2.9	8.75	6.05	6.25	7.65
28	7.9	8.15	5.35	5.4	3.35	4.8	1.7	2.45	9.85	5.75	6.0	7.95
29	8.85	.....	5.35	5.85	3.3	4.65	1.7	2.2	11.9	5.4	6.1	8.55
30	9.3	.....	5.05	6.2	3.25	4.3	1.7	1.95	15.9	5.25	6.0	7.95
31	9.3	.....	4.85	.....	3.2	.....	1.7	2.0	.....	5.2	.....	6.5

[a] Gage heights to top of ice Jan. 4 to 10.

NOTE.—Relation of gage height to discharge affected by ice about Jan. 3 to 12.

Daily discharge, in second-feet, of South Fork of Sangamon River near Taylorville, Ill., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	782	674	343	130	638	62	115	8	13	3,970	177	234
2	530	500	284	121	1,070	58	48	9	9	3,200	161	238
3	.....	363	266	209	1,220	54	40	9	8	2,700	114	217
4	.....	306	234	432	1,050	50	32	13	7	2,400	140	205
5	.....	266	209	509	674	44	27	11	8	2,020	144	197
6	.....	248	189	1,170	380	42	30	10	8	1,740	154	185
7	.....	279	213	1,400	297	44	21	10	44	1,520	181	185
8	.....	284	500	1,170	248	38	20	11	48	1,200	189	181
9	.....	306	901	758	217	38	18	8	252	926	205	185
10	.....	302	926	432	205	36	16	20	306	530	197	193
11	.....	274	782	328	193	34	15	24	205	432	193	234
12	.....	230	500	292	173	30	14	46	74	343	472	279
13	140	217	358	284	150	28	14	27	48	302	829	284
14	1,300	213	292	1,270	136	27	15	15	256	261	1,050	256
15	2,940	243	261	2,020	124	27	13	11	338	243	1,100	234
16	2,440	284	225	1,900	115	27	12	9	520	230	1,050	234
17	2,970	297	189	1,440	109	27	11	7	758	209	829	230
18	1,320	385	193	1,150	106	82	10	7	853	197	805	238
19	950	490	185	782	103	77	10	7	758	177	1,120	256
20	439	694	161	481	100	38	11	5	530	169	950	288
21	320	656	158	374	94	30	11	6	338	165	901	333
22	348	566	140	315	161	27	10	5	209	189	694	1,120
23	343	481	130	238	121	24	10	5	144	284	481	1,150
24	234	391	121	177	94	30	10	27	106	274	368	1,120
25	197	374	115	205	82	30	12	56	147	374	310	509
26	234	410	115	193	74	177	11	77	424	315	274	385
27	424	542	140	181	70	225	9	46	622	248	266	404
28	439	481	189	193	64	147	9	28	1,120	221	243	447
29	656	.....	189	230	62	136	9	21	2,140	193	252	566
30	853	.....	165	261	60	115	9	14	4,140	181	243	447
31	853	.....	150	.....	58	.....	9	15	.....	177	.....	288

NOTE.—Daily discharge determined from a discharge rating curve well defined between 58 and 1,440 second-feet (gage heights, 3.2 and 10.5 feet). Daily discharge, Jan. 3 to 12, estimated, because of ice, from climatologic records and discharge of adjacent drainage areas. Mean discharge, Jan. 3 to 12, estimated 118 second-feet, varying from about 40 to 300 second-feet.

Monthly discharge of South Fork of Sangamon River near Taylorville, Ill., for 1911.

[Drainage area, 427 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January [a]	2,970	.....	642	1.50	1.73	C.
February	694	213	384	.899	.94	B.
March	926	115	285	.667	.77	A.
April	2,020	121	622	1.46	1.63	B.
May	1,220	58	266	.623	.72	A.
June	225	24	60.1	.141	.16	B.
July	115	9	19.4	.045	.05	C.
August	77	5	18.3	.043	.05	C.
September	4,140	7	481	1.13	1.26	C.
October	3,970	165	819	1.92	2.21	B.
November	1,120	140	471	1.10	1.23	C.
December	1,150	181	365	.855	.99	B.
The year	4,140	5	369	.864	11.74	

[a] See footnotes to table of daily discharge.

SALT CREEK NEAR KENNEY, ILL.

Location.—At highway bridge, about 3 miles west of Kenney, Ill., near the west boundary of T. 19 N., R. 1 E., about three-fourths of a mile below the Vandalia Railroad bridge.

Records available.—February 14, 1908, to December 31, 1911.

Drainage area.—459 square miles.

Gage.—Standard chain gage attached to the bridge; datum unchanged.

Channel.—Section is at a pool; discharge measurements to date indicate that the point of control is not changing.

Discharge measurements.—Made from downstream side of bridge.

Floods.—The flood of 1882 is said to have been 1½ feet higher than that of 1908, or to have reached a height of about 16 feet by the present gage datum.

Winter flow. Ice affects the relation between gage height and discharge during portions of December, January, and February.

Discharge measurements of Salt Creek near Kenney, Ill., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Mar. 22	P. S. Monk	2.36	119
Oct. 12	Monk and Brown	3.83	383

Daily gage height, in feet, of Salt Creek near Kenney, Ill., for 1911.

[Chris. McDermott, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	[a]2.9	3.75	2.5	2.25	3.2	1.95	1.2	1.55	0.95	7.1	2.8	3.9
2	2.85	3.5	2.4	2.2	3.2	1.85	1.15	1.3	.95	8.0	2.75	3.5
3	2.55	3.3	2.4	2.25	3.0	1.75	1.15	1.2	.95	7.9	2.6	3.45
4	2.5	3.2	2.3	2.8	2.85	1.75	1.15	1.0	.95	7.0	2.6	3.25
5	2.45	3.0	2.25	3.25	2.75	1.7	1.0	1.0	.95	6.7	2.6	3.1
6	2.25	2.8	2.2	3.6	2.6	1.7	1.1	1.0	.9	5.9	2.8	3.0
7	2.1	2.5	3.0	3.45	2.5	1.75	1.0	1.0	1.0	4.4	2.9	2.95
8	2.0	2.65	4.4	3.6	2.45	1.7	1.15	1.0	2.85	4.9	3.0	2.95
9	2.0	2.75	4.4	3.25	2.4	1.6	1.05	1.0	1.85	4.6	2.95	3.0
10	2.0	2.5	4.0	3.1	2.4	1.55	1.0	1.0	1.5	4.3	2.9	3.05
11	1.9	2.55	3.25	2.9	2.3	1.5	1.0	1.0	4.1	4.05	2.9	3.2
12	1.9	2.5	3.55	2.9	2.25	1.45	2.25	.95	5.6	3.85	4.95	3.35
13	1.9	2.45	3.35	3.7	2.2	1.35	1.8	.95	6.15	3.7	5.7	3.3
14	8.0	3.0	3.25	5.8	2.1	1.4	1.35	.95	3.7	3.5	5.4	3.2
15	8.2	4.0	3.25	6.0	2.0	1.35	1.2	.95	3.5	3.4	5.0	3.0
16	8.7	3.85	2.85	5.7	2.0	1.35	1.2	1.2	4.25	3.3	4.45	3.15
17	7.8	3.65	2.75	5.2	2.0	1.25	1.1	1.0	4.2	3.5	5.7	3.1
18	5.0	3.6	2.7	4.5	2.0	1.3	1.2	1.0	3.65	3.45	6.55	3.0
19	4.85	3.65	2.65	4.2	1.9	1.4	1.05	.95	3.65	3.25	6.45	2.85
20	4.75	3.7	2.5	4.0	1.9	1.4	1.0	1.0	3.6	3.0	6.1	2.85
21	5.0	3.4	2.4	4.0	2.2	1.3	1.0	1.0	3.1	3.0	5.35	3.6
22	4.8	3.3	2.5	3.9	2.0	1.3	1.0	1.0	2.95	3.25	4.8	4.7
23	4.65	3.2	2.25	3.6	2.0	1.3	1.0	1.0	2.5	3.8	4.6	5.7
24	4.05	2.85	2.2	3.3	1.9	1.35	1.0	1.1	2.45	3.7	4.3	5.5
25	4.1	2.8	2.15	3.1	1.85	1.5	1.0	1.0	9.7	3.5	4.1	5.05
26	[a]6.2	2.75	2.25	3.0	1.75	1.45	1.05	1.2	9.7	3.3	3.9	4.7
27	9.5	2.55	2.6	3.0	1.7	1.5	1.1	1.1	9.0	3.2	3.75	5.2
28	7.2	2.55	2.5	2.95	1.7	1.35	1.0	1.0	8.2	3.0	4.2	4.85
29	6.85	.....	2.45	3.05	2.1	1.3	1.0	1.0	9.1	2.9	3.8	4.4
30	5.25	.....	2.4	3.2	1.8	1.25	1.0	1.0	8.1	2.85	3.65	4.5
31	4.5	.....	2.3	.....	1.9	.....	1.0	1.0	.....	2.9	.....	4.3

[a] Jan. 1 to 26, observer reported gage heights read to top of ice; Jan. 3, ice from 5 to 9 inches thick, and Jan. 10 ice 7 to 10 inches thick in the vicinity of the gage. It is probable that, subsequent to Jan. 13, the effect of backwater was very small.

NOTE.—Relation of gage height to discharge probably affected by ice about Jan. 4 to 13.

Daily discharge, in second-feet, of Salt Creek near Kenney, Ill., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	206	399	137	102	266	64	10	28	2	1,530	188	439
2	197	335	122	95	266	54	8	14	2	1,950	179	335
3	145	288	122	102	225	44	8	10	2	1,900	153	323
4	.....	266	108	188	197	44	8	3	2	1,490	153	277
5	.....	225	102	277	179	40	3	3	2	1,370	153	245
6	.....	188	95	360	153	40	6	3	1	1,070	188	225
7	.....	137	225	323	137	44	3	3	3	584	206	216
8	.....	162	584	360	130	40	8	3	197	738	225	216
9	.....	179	584	277	122	32	4.5	3	54	645	216	225
10	.....	137	467	245	122	28	3	3	25	554	206	235
11	.....	145	277	206	108	25	3	3	495	481	206	266
12	.....	137	348	206	102	22	102	2	966	426	754	300
13	.....	130	300	386	95	16	49	2	1,150	386	999	288
14	1,950	225	277	1,030	82	19	16	2	386	335	900	266
15	2,050	467	277	1,100	70	16	10	2	335	311	770	225
16	2,290	426	197	999	70	16	10	10	539	288	599	256
17	1,850	373	179	834	70	12	6	3	524	335	999	245
18	770	360	170	614	70	14	10	3	373	323	1,310	225
19	722	373	162	524	59	19	4.5	2	373	277	1,270	197
20	692	386	137	467	59	19	3	3	360	225	1,140	197
21	770	311	122	467	95	14	3	3	245	225	884	360
22	707	288	137	439	70	14	3	3	216	277	707	676
23	660	266	102	360	70	14	3	3	137	412	645	999
24	481	137	95	288	59	16	3	6	130	386	554	933
25	495	188	88	245	54	25	3	3	2,790	335	495	786
26	1,170	179	102	225	44	22	4.5	10	2,790	288	439	676
27	2,690	145	153	225	40	25	6	6	2,430	266	399	834
28	1,580	145	137	216	40	16	3	3	2,050	225	524	722
29	1,430	.....	130	235	82	14	3	3	2,480	206	412	584
30	850	.....	122	266	49	12	3	3	2,000	197	373	614
31	614	.....	108	.....	59	.....	3	3	.....	206	.....	554

NOTE.—Daily discharge determined from a discharge rating curve fairly well defined between 10 and 467 second-feet (gage heights 1.2 and 4 feet). Above 4 feet the rating curve is based on one discharge measurement at gage height 10.5 feet. Recent measurements appear to indicate that some of the early low-water discharge measurements are not reliable. Daily discharge Jan. 4 to 13 estimated, because of ice, from climatologic records, discharge of adjacent drainage areas, and observer's notes. Mean discharge Jan. 4 to 13 estimated about 62 second-feet, varying from about 45 to 100 second-feet.

Monthly discharge of Salt Creek near Kenney, Ill., for 1911.

[Drainage area, 459 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January [a]	2,690	.....	740	1.61	1.86	C.
February	467	130	252	.549	.57	A.
March	584	88	199	.434	.50	A.
April	1,100	95	389	.847	.94	A.
May	266	40	105	.229	.26	C.
June	64	12	26	.057	.06	C.
July	102	3	10.1	.022	.03	C.
August	28	2	4.9	.011	.01	D.
September	2,790	1	703	1.53	1.71	B.
October	1,950	197	588	1.28	1.48	B.
November	1,310	153	542	1.18	1.32	A.
December	999	197	417	.908	1.05	A.
The year	2,790	1	331	.721	9.79	

[a] See footnotes to tables of daily gage height and daily discharge.

CAHOKIA CREEK NEAR POAG, ILL.

Location.—At the Wabash Railroad bridge about three-fourths of a mile northeast of the Wabash Railroad station at Poag, Ill.

Records available.—December 13, 1909, to December 31, 1911.

Drainage area.—259 square miles.

Gage.—Standard chain gage fastened to bridge; datum unchanged.

Channel.—Probably permanent.

Discharge measurements.—Made from downstream side of bridge.

Floods.—Maximum gage height since establishment of gage—19.0 feet (discharge estimated about 3,600 second-feet)—occurred in October, 1911. See footnotes to tables of daily gage height and daily discharge. No record of floods prior to the establishment of the gage is available.

Winter flow.—Ice may affect the relation between gage height and discharge during short periods in December, January, and February.

Remarks.—The data collected are being used by the East Side Levee and Sanitary District of East St. Louis, Ill., in its study for flood control and prevention at that place. Cahokia Creek will soon be diverted westward into Mississippi River north of East St. Louis instead of flowing into the river south of East St. Louis.

Discharge measurements of Cahokia Creek near Poag, Ill., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Mar. 15	P. S. Monk	4.22	74
Oct. 18	Monk and Brown	3.13	39.5

Daily gage height, in feet, of Cahokia Creek near Poag, Ill., for 1911.

[S. T. Sanders, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.0	4.2	6.2	3.6	15.9	2.2	2.5	1.8	3.2	8.2	3.4	4.8
2	6.8	4.0	5.0	3.5	16.0	2.2	2.4	1.7	3.1	14.6	3.3	4.5
3	7.0	3.7	4.2	4.2	14.0	2.1	2.3	1.6	3.0	[a] 19.0	3.2	4.3
4	6.2	3.6	3.2	5.0	10.2	2.1	2.3	2.0	2.9	[a] 17.2	3.1	4.1
5	5.0	3.7	3.0	6.2	7.0	2.0	2.2	2.7	7.0	12.0	3.0	4.0
6	4.8	4.7	3.0	5.1	5.2	2.2	2.2	2.6	9.0	8.3	6.0	3.9
7	4.6	5.2	11.2	4.4	4.1	2.4	2.1	2.4	6.2	6.1	9.0	3.8
8	4.5	4.7	12.7	4.2	4.0	2.2	2.0	3.0	4.6	8.0	8.1	3.7
9	4.4	4.2	16.2	4.0	3.9	2.0	1.9	7.2	3.0	7.2	5.0	5.9
10	4.4	4.0	7.0	3.8	3.8	2.0	1.9	5.0	4.0	5.0	4.2	5.2
11	4.3	4.7	6.0	3.6	3.7	1.9	1.9	8.0	6.2	4.6	3.8	6.0
12	4.3	3.9	5.3	4.7	3.6	1.9	1.8	5.2	4.2	4.3	8.0	8.2
13	4.2	3.9	4.2	5.0	3.5	1.8	1.8	4.0	3.0	4.1	10.2	6.0
14	4.6	4.0	4.2	13.5	3.5	1.8	1.8	3.5	2.8	3.9	8.2	5.6
15	5.0	5.0	4.1	13.0	3.4	1.8	1.7	3.4	2.6	3.8	7.4	5.4
16	4.3	6.0	4.1	12.0	3.4	1.8	1.7	3.3	9.0	3.7	6.2	6.0
17	4.0	8.5	4.1	8.0	3.3	1.8	1.7	3.3	13.2	3.5	5.5	5.4
18	3.8	6.5	4.3	5.4	3.2	1.8	1.6	3.2	10.0	3.4	8.0	6.2
19	3.6	10.0	4.1	5.0	3.1	1.9	1.6	5.0	6.4	3.2	10.2	6.0
20	3.5	9.2	4.1	10.6	3.0	1.9	1.6	3.8	5.0	3.0	8.0	6.8
21	3.4	6.4	3.9	8.0	2.7	1.8	1.5	3.5	3.4	2.9	7.2	10.0
22	3.4	4.3	3.9	6.2	2.8	1.8	1.5	3.2	3.0	5.0	6.0	12.1
23	3.3	5.0	3.8	4.6	2.8	1.7	1.5	3.0	2.8	5.4	5.4	8.0
24	3.3	4.2	3.8	4.3	3.0	1.7	1.5	3.4	2.5	4.0	5.8	6.2
25	3.2	5.6	3.7	4.1	3.4	1.9	1.6	8.4	6.0	3.4	5.4	5.8
26	3.2	11.0	4.0	4.0	2.7	3.0	1.7	6.0	16.0	3.2	5.0	5.7
27	3.8	10.5	6.0	3.9	2.6	3.4	1.6	4.2	12.2	3.1	4.5	8.0
28	10.3	8.0	5.2	4.7	2.5	3.0	1.5	3.6	7.0	3.0	4.3	10.5
29	6.0	.....	4.3	9.0	2.4	2.8	1.5	3.6	5.1	2.9	6.3	7.1
30	5.1	.....	3.5	14.7	2.3	2.6	4.0	3.4	3.4	3.0	5.0	6.4
31	4.5	.....	3.4	.....	2.3	.....	2.0	3.3	.....	3.7	.....	6.0

[a] Oct. 3 and 4, extremely high stage caused by levee built by the East Side Levee and Sanitary District, which cut off flow into flood channel and confined entire flow to the main channel.

Daily discharge, in second-feet, of Cahokia Creek near Poag, Ill., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	167	75	180	53	2,520	19	25	11	41	383	47	103
2	230	67	113	50	2,630	19	23	9	38	1,610	44	88
3	249	56	75	75	1,440	17	21	7	35	[a]3,600	41	79
4	180	53	41	113	675	17	21	15	33	[a]2,700	38	71
5	113	56	35	180	249	15	19	29	249	1,000	35	67
6	103	98	35	118	123	19	19	27	488	395	167	63
7	93	123	849	83	71	23	17	23	180	173	488	59
8	88	98	1,150	75	67	19	15	35	93	359	371	56
9	83	75	675	67	63	15	13	269	35	269	113	161
10	83	67	249	59	59	15	13	113	67	113	75	123
11	79	58	167	53	56	13	13	359	180	93	59	167
12	79	63	128	98	53	13	11	123	75	79	359	383
13	75	63	75	113	50	11	11	67	35	71	675	167
14	93	67	75	1,330	50	11	11	50	31	63	383	143
15	113	113	71	1,210	47	11	9	47	27	59	289	133
16	79	167	71	1,000	47	11	9	44	488	56	180	167
17	67	420	71	359	44	11	9	44	1,260	50	138	133
18	59	204	79	133	41	11	7	41	641	47	359	180
19	53	641	71	113	38	13	7	113	196	41	675	167
20	50	517	71	743	35	13	7	59	113	35	359	230
21	47	196	63	359	29	11	5	50	47	33	269	641
22	47	79	63	180	31	11	5	41	35	113	167	1,020
23	44	113	59	93	31	9	5	35	31	133	133	359
24	44	75	59	79	35	9	5	47	25	67	155	180
25	41	143	56	71	47	13	7	407	167	47	133	155
26	41	811	67	67	29	35	9	167	2,630	41	113	149
27	59	726	167	63	27	47	7	75	1,040	38	88	359
28	692	359	123	98	25	35	5	53	249	35	79	692
29	167	.....	79	488	23	31	5	53	118	33	188	259
30	118	.....	50	1,640	21	27	67	47	47	35	113	196
31	88	.....	47	.....	21	.....	15	44	.....	56	.....	167

[a] Daily discharge Oct. 3 and 4 estimated (because of change in relation of gage height to discharge as noted under table of daily gage height) by means of an extension of discharge rating curve for unrestricted flow, above about 1,740 second-feet (gage height 15 feet), based upon a discharge measurement, in main channel only, of 2,320 second-feet at gage height 16.25 feet, as determined on Oct. 7, 1910.

NOTE.—Daily discharge determined from a discharge rating curve well defined between 35 and 1,350 second-feet (gage heights 3 and 13.6 feet). Above 1,350 second-feet (gage height 13.6 feet) the discharge rating curve is based on one discharge measurement at gage height 16.25 feet, made Oct. 7, 1910. No ice reported at this station; relation of gage height to discharge probably not affected by ice during 1911.

Monthly discharge of Cahokia Creek near Poag, Ill., for 1911.

[Drainage area, 259 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	692	41	114	0.440	0.51	B.
February	811	53	201	.776	.81	A.
March	1,150	35	165	.637	.73	A.
April	1,640	50	305	1.18	1.32	A.
May	2,630	21	280	1.08	1.24	A.
June	47	9	17.5	.068	.08	C.
July	67	5	13.4	.052	.06	C.
August	407	7	80.8	.312	.36	A.
September	2,630	25	290	1.12	1.25	A.
October	[a]3,600	33	382	1.47	1.70	B.
November	675	35	211	.815	.91	A.
December	1,020	56	223	.861	.99	A.
The year	[a]3,600	5	190	.734	9.96	

[a] October maximum estimated. See footnotes to tables of daily gage height and daily discharge.

KASKASKIA RIVER BASIN.

KASKASKIA RIVER NEAR ARCOLA, ILL.

Location.—At highway bridge known as the Bagdad Bridge, about 4 miles west of Arcola, Ill., in the northeast part of T. 14 N., R. 7 E.

Records available.—April 11, 1908, to December 31, 1911.

Drainage area.—390 square miles.

Gage.—Standard chain gage attached to bridge; datum unchanged.

Channel.—Probably permanent. Discharge measurements to date indicate that the point of control is permanent.

Discharge measurements.—Made from downstream side of bridge.

Floods.—The flood of May, 1908, reached a height of 17.3 feet on the gage.

Winter flow.—Ice affects the relation between gage height and discharge during portions of December, January, and February.

The following discharge measurement was made by Monk and Brown:
Oct. 13, 1911: Gage height, 6.20 feet; discharge, 344 second-feet.

Daily gage height, in feet, of Kaskaskia River near Arcola, Ill., for 1911.

[L. L. Pfeifer, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.6	9.8	5.4	4.7	7.5	2.9	1.65	0.9	1.7	14.6	5.1	6.9
2	5.4	9.1	5.3	6.7	7.4	2.8	1.6	.75	1.65	14.2	5.1	6.7
3	5.3	7.4	5.2	7.9	7.2	2.65	1.45	.8	1.75	13.8	5.0	6.5
4	5.3	6.7	5.2	8.1	7.0	3.0	1.5	.75	1.85	13.2	5.0	6.4
5	5.3	6.1	5.1	9.3	6.9	3.15	1.45	.75	1.9	11.1	4.9	6.2
6	5.2	6.0	6.7	9.9	6.7	3.0	1.4	.85	2.0	8.6	4.9	6.0
7	5.2	6.0	7.3	9.7	6.4	3.55	1.4	1.0	1.95	7.75	4.8	5.8
8	5.0	5.9	7.8	9.5	6.0	4.0	1.25	1.1	2.05	7.7	4.7	5.8
9	5.0	5.9	7.9	9.1	5.9	3.3	1.3	1.05	2.05	7.65	4.5	5.7
10	4.9	5.8	7.8	9.0	5.7	2.75	1.15	.95	2.2	7.55	4.5	5.4
11	4.8	5.7	7.7	8.6	5.7	2.2	1.2	.95	3.0	7.2	4.4	5.2
12	4.6	5.6	7.6	8.9	5.6	2.45	1.15	1.0	3.25	7.05	7.6	5.0
13	4.9	5.5	7.6	9.0	5.5	2.4	1.1	1.0	4.05	6.4	7.8	4.9
14	6.2	5.5	7.5	9.3	5.3	2.15	1.0	.95	4.35	6.0	8.0	4.9
15	7.4	5.7	6.9	10.0	5.1	2.1	.95	.95	4.8	6.0	8.1	4.8
16	7.2	5.8	6.9	9.8	5.0	2.1	1.0	1.2	5.1	5.9	8.2	4.7
17	7.2	6.0	6.8	9.6	5.0	2.05	.85	1.2	5.3	5.9	8.2	4.6
18	7.1	6.1	6.7	9.6	4.9	2.0	.9	1.15	6.0	5.8	8.3	4.6
19	7.1	6.3	6.5	9.4	4.9	1.95	.75	1.15	6.1	5.6	8.4	4.5
20	7.0	6.3	6.2	9.3	4.8	1.9	.8	1.15	6.15	5.9	8.4	4.6
21	6.9	6.2	6.0	9.0	4.6	1.85	.8	1.6	6.25	6.0	8.4	4.8
22	6.4	6.1	5.8	8.8	4.35	1.7	.75	2.0	6.25	6.1	8.3	4.9
23	6.3	6.0	5.7	8.7	4.3	1.6	.8	2.05	6.5	6.2	8.1	5.0
24	6.1	5.8	5.7	8.6	4.25	1.55	.75	2.05	6.6	6.1	7.9	5.1
25	6.8	5.7	5.5	8.5	4.1	1.8	.7	1.95	6.55	6.0	7.8	5.3
26	7.4	5.6	5.2	8.4	4.0	2.15	.55	2.0	6.75	5.8	7.6	5.3
27	9.1	5.5	5.2	8.4	3.75	2.1	.6	1.9	6.95	5.7	7.6	5.2
28	9.2	5.4	5.1	8.3	3.6	1.95	.6	1.85	10.0	5.4	7.4	5.2
29	10.3	...	5.0	8.0	3.35	1.8	.65	1.75	14.2	5.4	7.2	5.4
30	10.2	...	5.0	7.9	3.0	1.8	.9	1.75	15.1	5.2	7.0	5.6
31	10.0	...	4.9	...	2.85	...	.85	1.7	...	5.1	...	5.9

NOTE.—No notes relative to ice given by gage observer. Relation of gage height to discharge probably not affected by ice during 1911.

Daily discharge, in second-feet, of Kaskaskia River near Arcola, Ill., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	276	1,190	254	187	557	53	7	0.7	8	2,900	224	448
2	254	971	244	416	537	48	6	.4	7	2,750	224	416
3	244	537	234	642	500	40	4.5	.5	9	2,610	214	386
4	244	416	234	689	465	58	5	.4	11	2,390	214	372
5	244	332	224	1,030	448	67	4.5	.4	12	1,640	205	345
6	234	320	416	1,230	416	58	4	.6	15	822	205	320
7	234	320	518	1,160	372	94	4	1	14	609	196	298
8	214	309	620	1,100	320	130	2.5	1.5	16	598	187	298
9	214	309	642	971	309	77	3	1.2	16	588	170	287
10	205	298	620	940	287	46	1.8	.8	21	567	170	254
11	196	287	598	822	287	21	[a] 2	[a] .8	58	500	162	234
12	178	276	577	909	276	31	1.8	1	74	474	577	214
13	205	265	577	940	265	29	1.5	1	134	372	620	205
14	345	265	557	1,030	244	20	1	.8	158	320	665	205
15	537	287	448	1,260	224	18	.8	.8	196	320	689	196
16	500	298	448	1,190	214	18	1	2	224	309	714	187
17	500	320	432	1,130	214	16	.6	2	244	309	714	178
18	482	332	416	1,130	205	15	.7	1.8	320	298	740	178
19	482	358	386	1,070	205	14	.4	1.8	332	276	767	170
20	465	358	345	1,030	196	12	.5	1.8	338	309	767	178
21	448	345	320	940	178	11	.5	6	352	320	767	196
22	372	332	298	879	158	8	.4	15	352	332	740	205
23	358	320	287	850	154	6	.5	16	386	345	689	214
24	332	298	287	822	150	5.5	.4	16	401	332	642	224
25	432	287	265	794	138	10	.3	14	394	320	620	244
26	537	276	234	767	130	20	0	15	424	298	577	244
27	971	265	234	767	110	18	.1	12	456	287	577	234
28	1,000	254	224	740	98	14	.1	11	1,260	254	557	234
29	1,360	.....	214	660	80	10	.2	9	2,750	254	500	254
30	1,330	.....	214	642	58	10	.7	9	3,080	234	465	276
31	1,260	.....	205	.....	50	.....	.6	8	.....	224	.....	309

[a] July 11 and Aug. 11, observer reported river "standing in pools, not running." Determinations of daily discharge during July and August are approximate, but the flow is believed not to have been zero on July 11 and Aug. 11. The gage is in a large pool and the gage reader would probably be unable to detect very low velocities.

NOTE.—Daily discharge determined from a discharge rating curve well defined between 43 and 665 second-feet (gage heights 2.7 and 8 feet) and fairly well defined between 689 and 1,360 second-feet (gage heights 8.1 and 10.3 feet).

Monthly discharge of Kaskaskia River near Arcola, Ill., for 1911.

[Drainage area, 390 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	1,360	178	473	1.21	1.40	B.
February	1,190	254	372	.954	.99	A.
March	642	205	373	.956	1.10	A.
April	1,260	187	891	2.28	2.54	B.
May	557	50	253	.649	.75	A.
June	130	5.5	32.6	.084	.09	C.
July	7	[a] .0	1.82	.0047	.005	D.
August	16	[a] .4	4.91	.013	.01	D.
September	3,080	7	402	1.03	1.15	B.
October	2,900	224	715	1.83	2.11	B.
November	767	162	485	1.24	1.38	A.
December	448	170	258	.662	.76	A.
The year	3,080	.0	354	.908	12.28	

[a] See footnotes to table of daily discharge.

KASKASKIA RIVER AT SHELBYVILLE, ILL.

Location.—At highway bridge in the eastern edge of Shelbyville, Ill., just above the Chicago & Eastern Illinois and Big Four railroad bridges.

Records available.—February 25, 1908, to December 31, 1911.

Drainage area.—1,030 square miles.

Gage.—Standard chain gage attached to bridge; datum unchanged.

Channel.—Somewhat shifting; section is at a pool, and the point of control has remained unchanged.

Discharge measurements.—Made from downstream side of bridge and short approaches.

Floods.—Maximum gage height since establishment of the gage is 25.8 feet, which occurred in May, 1908. No records of floods prior to establishment of gage are available.

Winter flow.—Ice may affect the relation between gage height and discharge during portions of December, January, and February.

The following discharge measurement was made by Monk and Brown:

October 4, 1911: Gage height, 19.92 feet; discharge, 6,940 second-feet.

Daily gage height, in feet, of Kaskaskia River at Shelbyville, Ill., for 1911.

[Homer Pound, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	8.9	12.5	8.3	7.1	10.4	6.25	5.25	5.05	5.15	22.25	8.3	8.3
2	9.0	12.3	8.1	7.1	10.1	6.2	5.5	5.1	5.05	21.5	8.0	8.2
3	9.1	11.9	7.9	7.7	9.65	6.1	5.35	5.15	5.05	20.55	7.4	8.1
4	9.9	10.4	7.8	10.2	9.2	6.05	5.4	5.2	5.1	19.15	7.6	8.0
5	[a] 10.3	9.5	7.7	14.5	8.65	6.1	5.25	5.2	5.15	18.4	7.8	7.9
6	[a] 10.3	9.4	7.6	18.9	8.4	6.05	5.3	5.25	5.25	17.4	7.9	7.7
7	[a] 10.3	9.3	9.4	14.5	8.1	6.1	5.3	5.3	5.45	15.8	7.7	7.1
8	[a] 9.6	9.2	11.6	13.3	7.85	6.1	5.25	5.25	5.75	14.8	7.6	7.2
9	[a] 9.9	8.2	11.7	13.1	7.7	6.05	5.3	5.2	5.7	13.3	7.6	7.4
10	[a] 8.1	8.1	11.4	12.3	7.6	6.1	5.25	5.15	5.45	12.2	7.7	7.6
11	7.6	8.4	10.9	11.5	7.45	6.0	5.8	5.05	6.45	11.4	7.8	7.7
12	7.1	8.2	10.6	10.6	7.3	5.95	5.25	5.05	7.75	10.9	10.2	7.8
13	10.4	7.9	10.1	10.1	7.15	5.9	5.2	5.05	11.15	10.2	10.5	7.8
14	14.8	7.1	9.6	14.7	7.1	5.8	5.2	5.05	9.6	9.8	10.7	7.9
15	15.8	8.4	8.9	16.6	7.0	5.7	5.15	5.1	8.65	9.4	10.5	8.0
16	13.8	8.7	8.6	16.1	6.85	5.65	5.1	5.05	9.15	9.0	10.4	8.0
17	11.5	9.1	8.3	15.1	6.8	5.7	5.1	4.95	9.75	8.9	12.2	8.1
18	10.4	9.8	8.0	13.6	6.7	5.55	5.05	4.95	8.85	8.7	12.4	8.0
19	10.1	10.4	7.8	13.1	6.65	5.6	5.2	4.95	8.8	8.5	12.5	7.9
20	9.7	10.5	7.7	12.15	6.9	5.55	5.15	5.0	8.85	9.0	12.0	8.2
21	9.2	10.2	7.6	11.1	8.45	5.6	5.2	4.95	8.15	10.0	11.8	8.6
22	9.2	9.8	7.4	10.15	7.5	5.6	5.2	4.85	7.75	10.9	11.5	8.9
23	8.6	9.5	7.3	9.6	7.3	5.55	5.05	4.75	7.35	11.0	11.2	8.0
24	8.3	9.2	7.2	9.1	7.05	5.6	5.1	5.25	7.1	11.2	10.7	9.1
25	7.9	9.1	7.1	8.75	6.8	5.55	5.05	5.3	11.05	11.4	10.2	9.0
26	8.1	9.1	7.2	8.5	6.6	5.8	5.1	5.35	12.75	11.7	9.8	9.2
27	8.7	8.9	7.4	8.15	6.35	5.75	5.05	5.45	12.35	11.0	9.5	9.0
28	12.4	8.6	7.3	8.3	6.3	5.7	5.1	5.35	16.55	9.9	9.1	8.9
29	13.1	.....	7.3	8.3	6.45	5.5	5.1	5.25	19.7	9.5	8.8	8.7
30	12.9	.....	7.3	9.35	6.4	5.35	5.05	5.3	22.75	9.0	8.5	8.5
31	12.7	.....	7.1	.....	6.4	.....	5.1	5.15	.....	8.6	.	8.8

[a] Gage heights to top of ice Jan. 5 to 10.

NOTE.—Relation of gage height to discharge affected by ice about Jan. 3 to 10.

Daily discharge, in second-feet, of Kaskaskia River at Shelbyville, Ill., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,150	2,850	918	494	1,810	208	22	12	16	8,450	918	918
2	1,190	2,750	846	494	1,680	192	45	13	12	8,000	810	882
3	[a]1,100	2,550	774	702	1,470	160	30	16	12	7,430	596	846
4	[a]1,000	1,810	738	1,720	1,270	145	34	18	13	6,590	666	810
5	[a] 950	1,400	702	3,920	1,050	160	22	18	16	6,150	738	774
6	[a] 910	1,360	666	6,440	956	145	25	22	22	5,560	774	702
7	[a] 860	1,310	1,360	3,920	846	160	25	25	40	4,650	702	494
8	[a] 810	1,270	2,400	3,260	756	160	22	22	82	4,090	666	528
9	[a] 760	882	2,450	3,160	702	145	25	18	73	3,260	666	596
0	[a] 714	846	2,300	2,750	666	160	22	16	40	2,700	702	666
11	666	956	2,050	2,350	613	130	90	12	273	2,300	738	702
12	494	882	1,910	1,910	562	120	22	12	720	2,050	1,720	738
13	1,810	774	1,680	1,680	511	109	18	12	2,180	1,720	1,860	738
14	4,090	494	1,450	4,040	494	90	18	12	1,450	1,540	1,960	774
15	4,650	956	1,150	5,100	460	73	16	13	1,050	1,360	1,860	810
16	3,540	1,070	1,030	4,820	409	66	13	12	1,250	1,190	1,810	810
17	2,350	1,230	918	4,260	392	73	13	9	1,520	1,150	2,700	846
18	1,810	1,540	810	3,430	358	52	12	9	1,130	1,070	2,800	810
19	1,680	1,810	738	3,160	341	58	18	9	1,110	994	2,850	774
20	1,490	1,860	702	2,680	426	52	16	10	1,130	1,190	2,600	882
21	1,270	1,720	666	2,150	975	58	18	9	864	1,630	2,500	1,030
22	1,270	1,540	596	1,700	630	58	18	7	720	2,050	2,350	1,150
23	1,030	1,400	562	1,450	562	52	12	5.5	579	2,100	2,200	810
24	918	1,270	528	1,230	477	58	13	22	494	2,200	1,960	1,230
25	774	1,230	494	1,090	392	52	12	25	2,120	2,300	1,720	1,190
26	846	1,230	528	994	324	90	13	30	2,980	2,450	1,540	1,270
27	1,070	1,150	596	864	240	82	12	40	2,780	2,100	1,400	1,190
28	2,800	1,030	562	918	224	73	13	30	5,070	1,580	1,230	1,150
29	3,160	.....	562	918	273	45	13	22	6,920	1,400	1,110	1,070
30	3,050	.....	562	1,340	256	30	12	25	8,750	1,190	994	994
31	2,950	.....	494	.....	256	.....	13	16	.....	1,030	.....	1,110

[a] Daily discharge Jan. 3 to 10, estimated, because of ice, from climatologic records, run-off in adjacent drainage areas, and observer's notes.

NOTE.—Daily discharge determined from a discharge rating curve well defined between 224 and 7,100 second-feet (gage heights 6.3 and 20 feet). Above 6,500 second-feet (gage height 19.0 feet) the rating curve is a tangent. The relation of gage height to discharge during high water is liable to be affected by backwater caused by drift lodging at the two railroad bridges below the gaging station.

Monthly discharge of Kaskaskia River at Shelbyville, Ill., for 1911.

[Drainage area, 1,030 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January [a]	4,650	494	1,650	1.60	1.84	B.
February	2,850	494	1,400	1.36	1.42	A.
March	2,450	494	1,020	.990	1.14	A.
April	6,540	494	2,430	2.36	2.63	A.
May	1,810	224	657	.638	.74	A.
June	208	30	102	.099	.11	B.
July	90	12	21.2	.021	.02	C.
August	40	5.5	16.8	.016	.02	C.
September	8,750	12	1,450	1.41	1.57	A.
October	8,450	994	2,950	2.86	3.30	A.
November	2,850	596	1,500	1.46	1.63	A.
December	1,270	494	880	.854	.98	A.
The year [b]	8,750	5.5	1,170	1.14	15.40	

[a] See footnotes to tables of daily gage height and daily discharge.

[b] Attention is called to the fact that yearly mean discharge for 1909, published as 1,240 second-feet (Water-Supply Paper U. S. Geol. Survey No. 265, p. 197) should be 1,170 second-feet.

KASKASKIA RIVER AT VANDALIA, ILL.

Location.—At highway bridge at the east end of Main Street, Vandalia, Ill.

Records available.—February 26, 1908, to December 31, 1911.

Drainage area.—1,980 square miles.

Gage.—Standard chain gage attached to bridge; datum unchanged.

Channel.—Somewhat shifting; section is at a pool and the point of control is apparently permanent.

Discharge measurements.—Made from downstream side of bridge.

Floods.—The flood of May, 1908, reached a height of 21.2 feet on the gage.

Winter flow.—Ice may affect the relation between gage heights and discharge during portions of December, January, and February.

Remarks.—The river is leveed along the left bank for some miles above and below the station. It is claimed that the levees, by confining the floods, cause unusual floods along the right bank, and lawsuits to recover damages have resulted. During extreme floods the levees sometimes give way and so reduce the flood flow; this occurred during the floods of May, 1908, and October, 1911, flood water for several days passing around the gaging station. Former statements that all the flood water eventually passed the gaging station are in error.

Discharge measurements of Kaskaskia River at Vandalia, Ill., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Mar. 17	P. S. Monk	7.04	1,280
Oct. 17	Monk and Brown	8.19	1,760

Daily gage height, in feet, of Kaskaskia River at Vandalia, Ill., for 1911.

[W. F. Radcliff, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	8.7	11.6	9.35	5.2	16.3	5.4	2.15	1.15	1.15	17.6	8.35	7.3
2	9.6	10.95	8.45	4.95	16.5	4.75	2.1	1.15	1.2	19.75	7.4	7.05
3	10.35	10.65	7.9	7.35	14.85	3.85	2.85	1.2	1.15	20.4	6.6	6.95
4	8.95	10.2	7.6	11.0	9.3	3.0	2.8	1.15	1.15	20.0	6.0	6.75
5	8.8	9.3	8.15	13.05	7.95	2.85	2.75	1.15	2.25	19.75	6.1	6.65
6	8.5	8.95	9.75	14.8	6.7	2.8	2.75	1.15	3.1	18.75	7.2	6.4
7	7.9	8.6	12.15	14.75	6.6	2.65	2.65	1.7	4.1	18.5	8.8	6.15
8	7.7	8.55	14.95	14.15	5.1	2.5	2.5	2.2	4.5	18.25	8.15	5.9
9	7.2	8.4	16.2	13.55	4.7	2.5	2.4	2.05	4.85	17.7	7.6	5.9
10	6.6	8.3	14.65	13.3	4.1	2.45	2.25	1.5	5.2	16.45	6.75	6.1
11	6.15	8.1	12.0	12.95	3.85	2.45	2.7	1.3	5.05	15.35	6.35	7.4
12	5.6	7.65	10.45	12.35	3.75	2.35	3.6	1.15	5.65	13.9	5.85	8.7
13	5.35	7.15	9.55	11.25	3.65	2.75	2.25	1.2	8.55	11.75	5.7	9.5
14	10.9	6.9	8.75	11.05	3.6	2.3	1.4	1.15	11.05	9.45	5.4	9.35
15	14.1	6.6	8.55	14.75	3.45	2.15	1.35	1.15	11.9	8.5	5.5	8.4
16	14.9	7.35	7.55	16.05	3.35	2.15	1.35	1.15	13.3	7.95	9.75	8.85
17	12.95	8.7	7.15	16.1	3.3	1.95	1.35	1.15	15.55	7.75	12.2	9.5
18	11.95	9.2	6.75	15.4	3.15	1.7	1.3	1.1	14.0	7.75	14.3	9.5
19	10.5	11.15	6.8	14.95	2.75	1.55	1.3	1.05	10.6	7.55	13.3	8.25
20	9.6	12.25	6.25	14.4	3.0	1.35	1.25	.85	9.35	7.3	11.3	10.2
21	8.65	12.8	6.0	11.4	6.75	1.35	1.25	.85	8.55	6.9	10.2	12.8
22	7.6	11.0	5.8	10.25	10.05	1.35	1.25	.75	7.35	10.1	9.7	12.15
23	7.85	9.95	5.55	9.05	9.6	1.35	1.15	.8	6.65	14.15	9.8	9.75
24	7.1	9.8	5.3	8.6	9.25	1.3	1.2	1.25	6.1	13.55	9.8	9.0
25	6.7	10.2	5.0	8.25	8.7	1.25	1.15	1.7	5.55	11.65	9.6	8.75
26	6.5	11.9	5.5	7.85	8.5	1.2	1.15	1.7	12.3	11.15	9.05	8.25
27	9.55	12.05	6.1	7.4	8.2	1.15	1.15	1.4	15.2	9.75	8.8	8.1
28	12.15	10.4	6.95	7.25	7.4	2.55	1.15	1.3	15.7	9.2	8.5	7.85
29	14.0	.....	6.8	7.2	6.9	2.8	1.2	1.15	16.35	8.7	8.3	7.75
30	13.35	.....	5.65	13.1	6.5	2.25	1.15	1.15	16.8	8.5	7.8	7.65
31	12.45	.....	5.45	.....	6.05	.....	1.15	1.15	.....	8.35	.....	8.2

NOTE.—No ice notes kept by observer. Relation of gage height to discharge probably affected by ice Jan. 3 and 4. Relation of gage height to discharge affected by break in levee on east bank about Oct. 2 to 9.

Daily discharge, in second-feet, of Kaskaskia River at Vandalia, Ill., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,830	3,050	2,090	678	5,270	732	73	10	10	5,920	1,710	1,300
2	2,190	2,760	1,730	612	5,370	563	68	10	12	[b]9,000	1,340	1,200
3	[a]2,000	2,630	1,520	1,320	4,560	351	156	12	10	12,000	1,070	1,200
4	[a]1,900	2,430	1,410	2,780	2,070	180	149	10	10	13,000	900	1,140
5	1,870	2,070	1,620	3,710	1,540	156	142	10	83	13,000	928	1,070
6	1,750	1,930	2,250	4,530	1,100	149	142	10	198	12,000	1,270	1,010
7	1,520	1,790	3,300	4,510	1,070	128	128	35	408	10,000	1,870	956
8	1,450	1,770	4,610	4,220	651	110	110	78	503	8,000	1,640	872
9	1,270	1,710	5,220	3,940	551	110	99	64	588	[b]7,000	1,410	872
10	1,070	1,670	4,460	3,830	408	104	83	24	678	5,320	1,140	928
11	942	1,600	3,230	3,670	351	104	135	15	638	4,820	1,010	1,340
12	788	1,430	2,540	3,390	329	94	296	10	802	4,100	844	1,830
13	718	1,250	2,170	2,890	307	142	83	12	1,770	3,140	816	2,150
14	2,740	1,170	1,850	2,800	296	88	19	10	2,800	2,110	732	2,110
15	4,200	1,070	1,770	4,510	266	73	17	10	3,180	1,750	760	1,710
16	4,580	1,320	1,390	5,140	246	73	17	10	3,830	1,560	2,270	1,870
17	3,670	1,830	1,250	5,170	236	54	17	10	4,900	1,480	3,320	2,150
18	3,210	2,030	1,120	4,820	207	35	15	9	4,150	1,480	4,290	2,150
19	2,560	2,850	1,140	4,610	142	26	15	8	2,600	1,410	3,830	1,640
20	2,190	3,340	970	4,340	180	17	14	4.5	2,090	1,300	2,910	2,430
21	1,810	3,600	900	2,960	1,120	17	14	4.5	1,770	1,170	2,430	3,600
22	1,410	2,780	844	2,460	2,370	17	14	3.5	1,320	2,390	2,230	3,320
23	1,500	2,330	774	1,970	2,190	17	10	4	1,090	4,250	2,270	2,270
24	1,230	2,270	705	1,790	2,050	15	12	14	928	3,970	2,270	1,950
25	1,100	2,430	625	1,660	1,830	14	10	35	774	3,050	2,190	1,870
26	1,040	3,180	760	1,500	1,750	12	10	35	3,370	2,870	1,950	1,640
27	2,170	3,250	928	1,340	1,640	10	10	19	4,730	2,270	1,870	1,600
28	3,300	2,520	1,180	1,280	1,340	116	10	15	4,970	2,030	1,750	1,480
29	4,150	.....	1,140	1,270	1,170	149	12	10	5,300	1,830	1,670	1,480
30	3,850	.....	802	3,740	1,040	83	10	10	5,520	1,750	1,480	1,410
31	3,440	.....	746	.....	914	.....	10	10	.....	1,710	.....	1,640

[a] Daily discharge Jan. 3 and 4 estimated, because of ice, from climatologic records and run-off in adjacent drainage areas.

[b] Daily discharge Oct. 2 to 9 estimated, because break in levee on east bank allowed portion of flow to pass around gaging section, by comparison with discharge at Carlyle, Ill.

NOTE.—Daily discharge determined from a discharge rating curve well defined between 78 and 4,150 second-feet (gage heights 2.2 and 14 feet).

Monthly discharge of Kaskaskia River at Vandalia, Ill., for 1911.

[Drainage area, 1,980 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January [a]	4,580	718	2,180	1.10	1.27	B.
February	3,600	1,070	2,220	1.12	1.17	A.
March	5,220	625	1,780	.899	1.04	A.
April	5,170	612	3,050	1.54	1.72	A.
May	5,370	142	1,370	.692	.80	A.
June	732	10	125	.063	.07	B.
July	296	10	61.3	.031	.04	C.
August	78	3.5	16.8	.0085	.01	D.
September	5,520	10	1,970	.995	1.11	B.
October [a]	[b] 13,000	1,170	4,700	2.37	2.73	C.
November	4,290	732	1,810	.914	1.02	B.
December	3,600	872	1,680	.849	.98	B.
The year	[b] 13,000	3.5	1,740	.879	11.96	

[a] See footnotes to table of daily discharge.
[b] October maximum discharge estimated.

KASKASKIA RIVER AT CARLYLE, ILL.

Location.—At the Baltimore & Ohio Southwestern Railroad bridge about one-fourth mile east of the railroad station at Carlyle, Ill

Records available.—March 2, 1908, to December 31, 1911.

Drainage area.—2,680 square miles.

Gage.—Standard chain gage attached to bridge; datum unchanged.

Channel.—Probably shifting. Measurements to date indicate that the point of control is probably permanent. Main channel is broken by three bridge piers and flood channel by four additional piers.

Discharge measurements.—Made from downstream side of bridge.

Floods.—The flood of 1882, which is the highest known, is said to have attained a height of 1½ feet above the flood of 1908, or about 32.5 feet on the present gage.

Winter flow.—Ice may affect the relation between gage height and discharge during portions of December, January, and February.

Regulation.—A dam 3½ feet high, about 700 feet above the section, is used to store water for the city of Carlyle. The average amount pumped is about 3,500,000 gallons every 30 days, and during June, July, and August about 4,500,000 gallons every 30 days. The outfalls of one section of the city sewerage system and some private sewers are above the section, so that the diversion is negligible.

Discharge measurements of Kaskaskia River at Carlyle, Ill., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 16	P. S. Monk	16.62	3,010
Oct. 19	Monk and Brown	18.38	3,160
Nov. 2	P. S. Monk	12.24	1,470

Daily gage height, in feet, of Kaskaskia River at Carlyle, Ill., for 1911.

[A. J. Marcham and Geo. Klier, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	10.9	18.6	18.95	10.3	19.8	7.7	6.2	.....	5.8	18.6	12.6	13.7
2	12.3	18.2	16.7	9.9	20.8	7.7	6.1	.....	5.8	20.2	12.0	12.7
3	13.8	17.8	14.2	9.8	21.4	7.5	6.0	.....	5.7	20.5	11.4	12.1
4	15.1	16.9	12.85	10.5	21.7	7.45	5.95	.....	5.75	24.4	11.0	11.8
5	16.3	16.1	11.9	13.4	21.8	7.2	5.9	.....	5.7	26.6	10.5	11.5
6	15.7	15.0	11.55	17.4	21.6	7.15	6.0	.....	5.6	27.1	10.6	11.3
7	14.3	14.7	11.6	18.5	19.8	7.0	5.95	.....	5.6	27.2	12.5	10.9
8	13.2	15.5	15.9	19.0	17.7	6.9	5.9	5.6	5.9	26.8	13.3	10.7
9	12.8	15.6	18.65	19.4	13.6	6.8	5.85	5.55	6.5	26.2	12.7	10.5
10	12.3	15.1	19.4	19.6	11.9	6.7	5.8	.....	6.9	25.5	12.1	10.5
11	11.9	13.55	20.0	19.5	11.1	6.65	5.75	5.7	7.6	25.0	11.7	11.9
12	11.4	12.6	20.5	19.3	10.7	6.0	5.7	5.9	7.8	24.5	12.2	14.3
13	10.7	11.75	20.7	19.0	10.4	6.0	6.0	5.8	8.1	24.1	16.8	14.3
14	9.9	11.5	20.6	19.1	9.8	6.5	5.9	5.7	8.0	23.5	18.6	12.7
15	10.8	11.6	19.4	19.9	9.7	6.6	5.85	5.6	7.0	23.2	19.1	11.6
16	14.7	11.95	16.75	20.7	9.4	6.55	5.75	5.7	14.2	22.7	19.0	11.5
17	17.4	13.1	14.0	20.9	9.0	6.4	5.65	5.8	15.4	21.8	19.4	13.7
18	18.6	14.75	12.8	21.2	8.95	6.35	5.6	5.9	16.7	21.0	19.1	16.1
19	19.0	15.8	12.05	21.5	8.7	6.3	5.6	5.8	18.8	18.2	18.9	15.7
20	18.6	16.9	11.9	21.55	8.55	6.25	5.55	5.7	19.1	15.0	19.4	14.0
21	16.2	18.05	10.75	21.6	8.4	6.15	.....	5.6	19.2	12.9	19.9	15.2
22	14.4	18.9	10.1	21.65	8.3	6.1	.....	5.55	19.0	13.4	20.1	17.9
23	12.8	19.35	10.6	21.7	12.7	6.15	.....	.....	18.3	17.1	20.4	18.6
24	12.4	18.9	10.25	21.65	13.3	6.1	.....	.....	17.2	18.1	20.2	18.4
25	12.0	17.8	10.0	21.0	11.8	6.05	.....	.....	16.6	18.9	19.5	16.6
26	11.5	17.65	10.05	19.3	9.7	6.15	.....	.....	15.8	19.1	18.2	14.5
27	11.0	17.2	10.4	15.7	8.9	8.0	.....	.....	16.1	18.6	17.1	14.3
28	11.0	18.9	13.4	13.2	8.5	7.1	.....	.....	16.5	17.6	15.1	14.3
29	13.7	.....	13.95	12.2	8.2	6.4	5.6	5.5	16.9	15.1	14.7	15.6
30	17.8	.....	12.3	14.3	7.9	6.3	5.55	5.6	17.7	14.2	14.3	14.4
31	18.4	.....	10.95	.....	7.85	.....	.....	5.7	.....	13.4	.....	13.6

NOTE.—No ice notes kept by observer. Relation of gage height to discharge probably not affected by ice during 1911. July 21 to 28, July 31 to Aug. 7, Aug. 10, and Aug. 23 to 28, observer reported "Dry beneath gage," with a recorded gage height of 5.5 feet.

Daily discharge, in second-feet, of Kaskaskia River at Carlyle, Ill., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,250	3,630	3,780	1,100	4,210	442	132	35	72	3,630	1,720	2,030
2	1,630	3,470	2,960	994	4,950	442	116	30	72	4,460	1,550	1,750
3	2,060	3,330	2,180	968	5,660	394	100	30	59	4,690	1,390	1,580
4	2,450	3,030	1,790	1,150	6,110	382	93	30	66	10,200	1,280	1,500
5	2,830	2,760	1,520	1,950	6,270	324	86	25	59	13,600	1,150	1,420
6	2,640	2,420	1,430	3,200	5,960	313	100	25	47	14,300	1,180	1,360
7	2,210	2,330	1,440	3,580	4,210	280	93	35	47	14,500	1,690	1,250
8	1,890	2,580	2,700	3,800	3,300	260	86	47	86	13,900	1,920	1,200
9	1,770	2,610	3,650	3,990	2,000	240	79	41	184	13,000	1,750	1,150
10	1,630	2,450	3,990	4,100	1,520	220	72	37	260	11,900	1,580	1,150
11	1,520	1,990	4,330	4,050	1,310	211	66	59	418	11,100	1,470	1,520
12	1,390	1,720	4,690	3,940	1,200	100	59	86	466	10,400	1,610	2,210
13	1,200	1,480	4,860	3,800	1,120	100	100	72	540	9,760	2,990	2,210
14	994	1,420	4,770	3,850	968	184	86	59	515	8,850	3,630	1,750
15	1,230	1,440	3,990	4,270	942	202	79	47	280	8,390	3,850	1,440
16	2,330	1,540	2,980	4,860	865	193	66	59	2,180	7,630	3,800	1,420
17	3,200	1,860	2,120	5,050	765	166	53	72	2,540	6,270	3,990	2,030
18	3,630	2,340	1,770	5,380	752	157	47	86	2,960	5,150	3,850	2,760
19	3,800	2,670	1,560	5,810	690	148	47	72	3,710	3,470	3,760	2,640
20	3,630	3,030	1,520	5,890	652	140	41	59	3,850	2,420	3,990	2,120
21	2,800	3,420	1,220	5,960	615	124	35	47	3,890	1,800	4,270	2,480
22	2,240	3,760	1,050	6,040	590	116	35	41	3,800	1,950	4,390	3,370
23	1,770	3,970	1,180	6,110	1,750	124	30	35	3,510	3,090	4,610	3,630
24	1,660	3,760	1,080	6,040	1,920	116	30	35	3,130	3,440	4,460	3,550
25	1,550	3,330	1,020	5,150	1,500	108	25	30	2,930	3,760	4,050	2,930
26	1,420	3,280	1,030	3,940	942	124	25	30	2,670	3,850	3,470	2,270
27	1,280	3,130	1,120	2,640	740	515	25	30	2,760	3,630	3,090	2,210
28	1,280	3,760	1,950	1,890	640	302	35	35	2,960	3,260	2,450	2,210
29	2,030	.....	2,110	1,610	565	166	47	40	3,030	2,450	2,330	2,610
30	3,330	.....	1,630	2,210	490	148	41	47	3,300	2,180	2,210	2,240
31	3,550	.....	1,270	.....	478	.....	35	59	.....	1,950	.....	2,000

NOTE.—Daily discharge determined by means of a discharge rating curve well defined between 72 and 7,180 second-feet (gage heights 5.8 and 22.4 feet). Daily discharge July 21 to 28, July 31 to Aug. 7, Aug. 10, and Aug. 23 to 29, estimated, because of observer's inability to obtain gage height, from comparison with hydrograph of daily discharge at Vandalia and New Athens, Ill.

Monthly discharge of Kaskaskia River at Carlyle, Ill., for 1911.

[Drainage area, 2,680 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	3,800	994	2,140	0.799	0.92	A.
February	3,970	1,420	2,730	1.02	1.06	A.
March	4,860	1,020	2,340	.873	1.01	A.
April	6,110	968	3,780	1.41	1.57	A.
May	6,270	478	2,050	.765	.88	A.
June	515	100	225	.084	.09	A.
July [a]	132	[b] 25	63.4	.024	.03	C.
August [a]	86	[b] 25	46.3	.017	.02	D.
September	3,890	47	1,680	.627	.70	B.
October	14,500	1,800	6,740	2.52	2.90	B.
November	4,610	1,150	2,780	1.04	1.16	A.
December	3,630	1,150	2,060	.769	.89	A.
The year	14,500	[b] 25	2,220	.829	11.23	

[a] See footnote to tables of daily gage height and daily discharge for notes relative to periods of estimated discharge during July and August.

[b] July and August minima estimated.

KASKASKIA RIVER AT NEW ATHENS, ILL.

Location.—At the Illinois Central Railroad bridge, about 600 feet north of the railroad station at New Athens, Ill., about 1 mile below the mouth of Silver Creek and 3 miles above the mouth of Lively Creek.

Records available.—January 23, 1907, to December 31, 1911. A record of river heights from January 23, 1907, to October 28, 1909, was kept by C. J. von Roth Roffy, the present observer, for the New Athens Journal. The river height was taken on Wednesday and Thursday mornings of each week, the river height for Thursday being published Friday with the change in 24 hours as obtained from the river height of Wednesday. This record was kept for the information of farmers living on the west side of the river, who were cut off from reaching town when the river reached a height of 30 feet. The record is authentic. The gage heights have been reduced to the present datum, the maximum error probably not being over 0.4 foot, decreasing as the stage increases. The present gage was installed November 1, 1909.

Drainage area.—5,220 square miles.

Gage.—Standard chain gage attached to the bridge; datum unchanged.

Channel.—Probably permanent; broken by one bridge pier at ordinary stages and three piers at high stages. Measurements to date indicate that point of control is permanent.

Discharge measurements.—Made from downstream lower chord of bridge and from wooden trestle approaches.

Floods.—The flood of the fall of 1898 reached a height of about 34.5 feet by the present datum.

Winter flow.—The relation between gage height and discharge may be slightly affected by ice during portions of December, January, and February.

Discharge measurements of Kaskaskia River at New Athens, Ill., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
1911.		*Feet.*	*Sec.-feet.*
Mar. 13	P. S. Monk	18.48	8,630
Oct. 23	Monk and Brown	15.18	5,080
Nov. 4	P. S. Monk	8.65	1,930

Daily gage height, in feet, of Kaskaskia River at New Athens, Ill., for 1911.

[C. J. von Roth Roffy, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.7	14.2	18.6	9.25	22.6	5.55	4.2	2.6	2.75	19.35	10.4	11.5
2	8.1	13.9	17.8	8.3	24.55	5.35	3.95	2.6	2.7	19.75	9.7	11.0
3	8.5	13.65	16.85	7.75	24.8	5.25	3.9	3.8	2.65	20.0	9.2	10.3
4	[a] 9.6	13.25	14.6	7.5	24.4	5.15	3.75	3.15	2.6	19.98	8.7	9.65
5	[a] 9.9	12.75	12.0	8.5	24.1	5.1	3.6	3.05	2.6	19.8	8.3	9.2
6	[a] 10.55	12.1	10.55	11.8	23.7	5.0	3.45	3.45	2.6	19.8	8.0	8.9
7	[a] 10.7	11.5	10.45	15.0	23.3	4.75	3.35	3.3	4.1	19.95	8.1	8.6
8	[a] 10.35	11.55	12.8	16.45	22.7	4.55	3.25	3.5	7.65	20.35	8.9	8.3
9	9.2	12.1	15.45	16.5	21.9	4.45	3.15	3.0	7.55	20.95	10.7	8.05
10	8.25	12.1	17.0	15.7	20.9	4.35	3.1	3.2	6.8	21.6	11.0	7.85
11	7.7	11.55	17.95	14.85	18.35	4.25	4.35	3.5	6.8	22.2	10.1	7.9
12	8.0	10.65	18.5	14.45	12.6	4.1	4.0	5.6	6.75	22.75	9.2	8.4
13	8.0	9.75	18.55	16.35	9.55	4.05	3.5	6.05	8.3	23.05	12.8	10.2
14	7.5	9.15	17.9	18.85	8.6	4.0	3.2	5.25	7.9	23.1	15.3	11.8
15	7.2	8.7	17.0	19.75	8.05	3.95	3.15	4.15	6.45	22.9	16.55	11.25

[a] Jan. 4 to 8 gage heights to top of ice. River reported frozen over from Jan. 4 to 6.

Daily gage height, in feet, of Kaskaskia River at New Athens, Ill., for 1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	7.2	8.5	16.1	19.9	7.6	3.9	3.3	3.5	5.4	22.65	16.95	10.05
17	9.05	8.75	14.85	20.1	7.25	3.9	3.2	3.15	8.2	22.35	16.5	10.05
18	11.05	10.25	12.7	20.3	6.95	3.85	3.05	3.0	13.95	21.95	15.5	11.1
19	12.05	12.6	10.85	20.5	6.7	3.8	2.95	2.8	15.8	21.55	15.05	12.55
20	12.9	15.3	10.05	20.35	6.45	3.7	2.9	2.75	16.35	21.05	15.9	13.1
21	13.25	16.7	9.55	19.95	6.25	3.65	2.85	2.7	16.5	20.5	16.55	12.9
22	12.65	17.5	9.2	19.5	8.05	3.6	2.8	3.2	16.2	19.35	16.3	14.4
23	11.15	17.8	8.75	19.0	7.25	3.55	2.75	2.9	14.95	16.2	15.7	16.0
24	9.75	17.8	8.3	18.4	6.9	3.55	2.75	2.75	12.3	14.25	15.4	17.05
25	9.1	17.55	7.85	17.9	8.95	3.5	2.7	2.65	9.5	14.7	15.5	17.4
26	8.8	17.5	7.7	17.4	8.75	3.5	2.7	2.6	8.8	14.5	15.35	16.6
27	8.45	17.65	8.25	16.95	7.65	3.95	2.65	2.55	15.7	14.15	14.95	14.55
28	8.2	17.85	9.2	15.85	6.75	4.0	2.65	2.5	17.55	13.9	14.05	13.0
29	8.45	.....	10.45	12.85	6.15	5.05	2.6	2.65	18.4	13.5	12.9	13.35
30	12.05	.....	11.4	19.35	5.8	4.7	2.6	2.9	18.95	12.5	11.95	13.6
31	14.2	.....	10.65	.....	5.85	.....	2.6	2.75	.....	11.3	.....	13.2

NOTE.—Relation of gage height to discharge affected by ice about Jan. 4 to 10.

Daily discharge, in second-feet, of Kaskaskia River at New Athens, Ill., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,130	5,160	8,130	2,340	17,900	724	414	174	192	9,520	2,970	3,580
2	1,750	4,970	7,950	1,850	24,600	669	369	174	186	10,000	2,580	3,300
3	1,950	4,820	7,140	1,580	25,500	643	360	344	180	10,300	2,310	2,920
4	a1,900	4,580	5,440	1,470	24,100	618	336	243	174	10,300	2,050	2,560
5	a1,850	4,280	3,850	1,950	23,000	606	312	229	174	10,100	1,850	2,310
6	a1,800	3,900	3,050	3,740	21,700	582	288	288	174	10,100	1,700	2,150
7	a1,750	3,580	3,000	5,720	20,300	527	272	264	396	10,300	1,750	2,000
8	a1,700	3,600	4,310	6,820	18,200	484	257	296	1,540	10,900	2,150	1,850
9	a1,650	3,900	6,040	6,860	15,500	464	243	222	1,490	12,200	3,140	1,720
10	a1,600	3,900	7,260	6,230	12,100	444	236	250	1,170	14,400	3,300	1,630
11	1,560	3,600	8,080	5,620	8,460	424	444	296	1,170	16,500	2,800	1,650
12	1,700	3,110	8,610	5,340	4,190	396	378	738	1,150	18,400	2,310	1,900
13	1,700	2,610	8,660	6,740	2,500	387	296	887	1,850	19,400	4,310	2,860
14	1,470	2,280	8,040	8,960	2,000	378	250	643	1,650	19,600	5,930	3,740
15	1,340	2,050	7,260	10,000	1,720	369	243	405	1,030	18,900	6,900	3,440
16	1,340	1,950	6,540	10,200	1,510	360	264	296	682	18,000	7,220	2,780
17	2,230	2,080	5,620	10,500	1,360	360	250	243	1,800	17,000	6,860	2,780
18	3,330	2,890	4,250	10,800	1,230	352	229	222	5,000	15,600	6,070	3,360
19	3,880	4,190	3,220	11,100	1,130	344	216	198	6,310	14,200	5,760	4,160
20	4,370	5,930	2,780	10,900	1,030	328	210	192	6,740	12,500	6,390	4,490
21	4,580	7,020	2,500	10,300	956	320	204	186	6,860	11,100	6,900	4,370
22	4,220	7,680	2,310	9,700	1,720	312	198	250	6,620	9,520	6,700	5,300
23	3,380	7,950	2,080	9,120	1,360	304	192	210	5,680	6,620	6,230	6,470
24	2,610	7,950	1,850	8,510	1,210	304	192	192	4,020	5,200	6,000	7,300
25	2,260	7,730	1,630	8,040	2,180	296	186	180	2,480	5,510	6,070	7,600
26	2,100	7,680	1,560	7,600	2,080	296	186	174	2,100	5,370	5,960	6,940
27	1,920	7,820	1,820	7,220	1,540	369	180	168	6,230	5,120	5,680	5,400
28	1,800	8,000	2,310	6,350	1,150	378	180	162	7,730	4,970	5,060	4,430
29	1,920	.....	3,000	4,340	921	594	174	180	8,510	4,730	4,370	4,640
30	3,880	.....	3,520	9,520	802	516	174	210	9,060	4,130	3,820	4,790
31	5,160	.....	3,110	.....	819	.....	174	192	.....	3,460	.....	4,550

a Daily discharge Jan. 4 to 10, estimated, because of ice, from observer's notes, climatologic records, and comparison with discharge at other stations in the Kaskaskia drainage basin.

NOTE.—Daily discharge determined from a discharge rating curve well defined between discharges 378 and 12,400 second-feet (gage heights 4.0 and 21.0 feet).

Monthly discharge of Kaskaskia River at New Athens, Ill., for 1911.

[Drainage area, 5,220 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January [a]	5,160	1,130	2,380	0.456	0.53	B.
February	8,000	1,950	4,830	.925	.96	B.
March	8,660	1,560	4,670	.895	1.03	B.
April	11,100	1,470	6,980	1.34	1.50	A.
May	25,500	802	7,830	1.50	1.73	A.
June	724	296	438	.084	.09	A.
July	444	174	255	.049	.06	C.
August	887	162	281	.054	.06	C.
September	9,060	174	3,080	.590	.66	A.
October	19,600	3,460	11,100	2.13	2.46	B.
November	7,220	1,700	4,500	.862	.96	B.
December	7,600	1,630	3,770	.722	.83	B.
The year	25,500	162	4,180	.801	10.87	

[a] See footnotes to tables of daily gage height and daily discharge.

SHOAL CREEK NEAR BREESE, ILL.

Location.—At the Baltimore & Ohio Southwestern Railroad bridge about 1½ miles east of Breese, Ill., and about 3 miles above the mouth of Beaver Creek.

Records available.—November 5, 1909, to December 31, 1911.

Drainage area.—760 square miles.

Gage.—Standard chain gage attached to bridge, datum unchanged.

Channel.—Practically permanent; rough; rock was placed in bed of stream under bridge to prevent scour.

Discharge measurements.—Made from upstream side of bridge and also from downstream side of wooden trestle during floods. There is a good wading section just above the bridge.

Floods.—The maximum gage height since establishment of the gage—19.6 feet—occurred in October, 1911. No records of floods prior to establishment of gage are available.

Winter flow.—The relation between gage height and discharge may be slightly affected by ice during short periods in December, January, and February.

Regulation.—The intake of the Breese pumping system is about one-fourth mile above the section, but the diversion is negligible.

Remarks.—The stream is fed by springs and has never been known to go dry at this point.

Discharge measurements of Shoal Creek near Breese, Ill., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Mar. 16	P. S. Monk	2.60	185
Oct. 20	Monk and Brown	1.78	116

Daily gage height, in feet, of Shoal Creek near Breese, Ill., for 1911.

[John Nordman, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.1	3.4	8.5	2.0	16.4	1.6	1.4	1.15	1.3	11.2	1.7	2.2
2	2.9	3.1	4.4	1.95	16.55	1.55	1.4	1.1	1.25	12.45	1.7	2.1
3	4.5	2.5	3.65	2.25	16.9	1.5	1.4	1.1	1.2	15.6	1.7	2.05
4	3.6	2.0	3.2	3.7	16.95	1.5	1.4	1.15	1.2	17.6	1.7	2.0
5	3.0	1.9	2.85	8.3	14.5	1.5	1.4	1.15	1.4	19.55	1.7	2.0
6	2.3	2.7	2.7	13.3	6.2	1.45	1.35	1.1	2.1	19.5	2.0	1.9
7	1.95	4.1	6.05	11.2	5.3	1.4	1.35	1.1	2.8	18.2	5.8	1.9
8	1.85	6.2	14.35	5.6	3.25	1.4	1.35	1.1	3.6	16.85	5.2	1.9
9	1.7	3.9	15.7	4.1	2.8	1.3	1.3	2.4	5.35	10.2	4.7	1.9
10	1.7	2.8	15.95	3.75	2.2	1.3	1.25	4.2	3.7	5.7	2.1	2.1
11	1.7	2.45	11.75	2.4	1.95	1.3	1.2	3.9	3.9	3.85	1.9	3.2
12	1.7	2.2	6.4	2.3	1.4	1.25	1.2	2.65	3.6	3.2	4.5	5.4
13	1.85	1.95	3.75	7.15	1.35	1.25	1.2	2.1	3.55	2.45	12.1	4.0
14	2.1	2.1	3.7	12.05	1.9	1.25	1.2	1.9	3.5	2.2	12.0	2.75
15	1.85	2.55	3.15	15.2	1.85	1.25	1.15	1.45	3.25	2.15	6.3	2.5
16	5.7	3.45	2.6	15.7	1.8	1.25	1.15	1.4	6.1	2.0	4.4	3.1
17	3.3	4.8	2.4	9.5	1.8	1.25	1.15	1.35	12.6	1.9	4.0	3.7
18	2.8	6.85	2.35	5.9	1.7	1.25	1.15	1.3	12.4	1.85	10.5	4.9
19	2.1	9.2	2.5	5.7	1.6	1.25	1.15	1.2	9.2	1.8	12.8	3.4
20	1.9	13.8	2.3	5.2	1.55	1.25	1.15	1.2	6.15	1.8	9.1	4.1
21	1.85	12.85	2.1	4.9	1.5	1.25	1.15	1.2	2.9	1.85	5.85	8.8
22	1.75	10.1	2.0	4.5	1.7	1.25	1.15	1.2	1.95	2.7	3.6	13.6
23	1.7	6.85	1.95	4.2	1.65	1.25	1.15	1.2	1.7	8.75	3.45	12.9
24	1.75	6.75	1.9	3.9	1.5	1.3	1.15	1.2	1.65	5.25	3.4	8.9
25	1.85	6.7	1.8	3.7	1.6	1.4	1.1	1.2	6.2	2.9	3.0	7.2
26	1.8	10.2	1.85	3.4	1.55	2.5	1.1	1.2	13.9	2.4	2.7	3.8
27	1.95	13.2	4.65	2.05	1.4	2.2	1.1	1.2	14.9	2.0	2.35	5.2
28	6.6	13.75	5.6	2.2	1.3	1.7	1.05	1.35	12.2	1.9	2.2	9.4
29	12.4	.....	3.4	4.25	1.3	1.55	1.05	1.5	7.8	1.9	2.0	5.1
30	7.45	.....	2.2	7.6	1.4	1.4	1.2	1.6	10.55	1.8	2.4	3.5
31	4.1	.....	2.1	.....	1.45	.....	1.15	1.55	.....	1.75	.....	4.2

NOTE.—No ice reported by observer. Relation of gage height to discharge probably not affected by ice during 1911.

Daily discharge, in second-feet, of Shoal Creek near Breese, Ill., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	132	299	1,200	123	3,050	90	74	54	66	1,740	98	141
2	221	251	468	118	3,130	86	74	51	62	2,000	98	132
3	485	172	340	146	3,450	82	74	51	58	2,740	98	128
4	332	123	267	349	3,510	82	74	54	58	4,290	98	123
5	235	114	214	1,170	2,450	82	74	54	74	6,820	98	123
6	151	195	195	2,190	786	78	70	51	132	6,750	123	114
7	118	417	759	1,740	624	74	70	51	208	5,060	714	114
8	110	786	2,420	678	275	74	70	51	332	3,400	606	114
9	98	383	2,770	417	208	66	66	161	633	1,540	519	114
10	98	208	2,860	358	141	66	62	434	349	696	132	132
11	98	166	1,850	161	118	66	58	383	383	374	114	267
12	98	141	822	151	74	62	58	189	332	267	485	642
13	110	118	358	957	70	62	58	132	324	166	1,920	400
14	132	132	349	1,910	114	62	58	114	315	141	1,900	202
15	110	178	259	2,620	110	62	54	78	275	136	804	172
16	696	307	183	2,770	106	62	54	74	768	123	468	251
17	283	536	161	1,400	106	62	54	70	2,030	114	400	349
18	208	903	156	732	98	62	54	66	1,990	110	1,600	553
19	132	1,340	172	696	90	62	54	58	1,340	106	2,080	299
20	114	2,300	151	606	86	62	54	58	777	106	1,320	417
21	110	2,090	132	553	82	62	54	58	221	110	723	1,260
22	102	1,520	123	485	98	62	54	58	118	105	332	2,250
23	98	903	118	434	94	62	54	58	98	1,250	307	2,100
24	102	885	114	383	82	66	54	58	94	615	299	1,280
25	110	876	106	349	90	74	51	58	786	221	235	966
26	106	1,540	110	299	86	172	51	58	2,320	161	195	366
27	118	2,160	510	128	74	141	51	58	2,550	123	156	606
28	858	2,280	678	141	66	98	48	70	1,940	114	141	1,380
29	1,990	.....	299	442	66	86	48	82	1,070	114	123	588
30	1,010	.....	141	1,040	74	74	58	90	1,610	106	161	315
31	417	.....	132	.....	78	.....	54	86	.....	102	.....	434

NOTE.—Daily discharge determined from a discharge rating curve well defined between 90 and 400 second-feet (gage heights 1.6 and 4 feet); poorly defined between 417 and 4,170 second-feet (gage heights 4.1 and 17.5 feet); and simply an extension above 4,170 second-feet (gage height 17.5 feet).

Monthly discharge of Shoal Creek near Breese, Ill., for 1911.

[Drainage area, 760 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	1,990	98	290	0.382	0.44	A.
February	2,300	114	780	1.03	1.07	B.
March	2,860	106	594	.782	.90	A.
April	2,770	118	785	1.03	1.15	B.
May	3,510	66	629	.828	.95	B.
June	172	62	76.7	.101	.11	C.
July	74	48	59.4	.078	.09	C.
August	434	51	95.7	.126	.15	C.
September	2,550	58	710	.934	1.04	A.
October	6,820	102	1,280	1.68	1.94	B.
November	2,080	98	545	.717	.80	A.
December	2,250	114	527	.693	.80	A.
The year	6,820	48	529	.696	9.44	

SILVER CREEK NEAR LEBANON, ILL.

Location.—At highway bridge at Wright's Crossing, about 2 miles west of Lebanon, Ill., between the Baltimore & Ohio Southwestern and East St. Louis & Suburban Railroad bridges across Silver Creek.

Records available.—March 3, 1908, to December 31, 1911.

Drainage area.—335 square miles.

Gage.—Standard chain gage attached to bridge; datum unchanged. From March 3, 1908, to May 10, 1909, the gage was so situated that 2 feet was the lowest obtainable reading, and the gage reader noted that the stream was dry whenever the water surface was below 2 feet. Upon inquiry he stated that the stream was dry for only one week during 1908; therefore, where the gage heights have been marked "Dry" during this period this note was inserted: "Dry under gage; can not obtain gage height of water surface." The position of the gage was changed on May 10, 1909, so as to obviate this difficulty.

Channel.—Probably permanent.

Discharge measurements.—Made from downstream side of bridge and small approach spans, and also, at high stages, from downstream side of three steel viaducts on road west of bridge.

Floods.—The maximum gage height since establishment of gage is 15.9 feet, which occurred in May, 1908. No records of floods prior to the establishment of the station are available.

Winter flow.—Ice may affect the relation of gage height to discharge during portions of December, January, and February.

Discharge measurements of Silver Creek near Lebanon, Ill., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Mar. 14	P. S. Monk	3.80	84
Oct. 21	Monk and Brown	2.77	32.3

Daily gage height, in feet, of Silver Creek near Lebanon, Ill., for 1911.

[E. C. Turner, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.6	6.2	3.25	14.8	.....	1.95	0.85	1.4	10.8	2.6	4.05
2	.....	3.4	4.8	3.2	14.5	.....	1.8	.8	1.4	10.0	2.7	3.5
3	.....	3.3	4.3	3.2	13.1	.....	1.7	.7	1.4	10.3	2.6	3.3
4	3.05	3.2	4.0	5.0	12.3	.....	1.6	1.6	1.3	11.1	2.6	3.2
5	.....	3.1	4.0	9.3	11.2	2.1	1.55	1.8	4.0	12.9	2.6	3.1
6	.....	5.6	4.0	10.3	6.1	2.1	1.4	1.7	6.1	12.45	3.35	3.0
7	.....	4.9	4.0	9.0	4.3	2.1	1.3	1.5	8.3	11.0	4.45	2.95
8	.....	4.9	10.05	5.1	3.6	2.0	1.2	1.55	5.4	9.6	6.0	2.95
9	.....	4.5	10.8	3.8	3.4	1.9	1.1	2.5	5.4	7.0	4.6	10.1
10	.....	4.0	11.9	3.4	3.3	1.85	1.05	2.7	4.4	3.95	3.6	(a)
11	3.0	3.6	11.1	3.3	3.2	1.8	1.0	9.5	4.0	3.3	3.0	(a)
12	3.0	3.2	9.9	3.4	3.1	1.7	1.2	8.8	6.95	2.9	9.7	(a)
13	3.0	3.25	5.3	8.3	3.0	1.6	1.5	4.4	4.1	2.9	10.0	(a)
14	3.0	3.3	3.8	10.7	2.9	1.6	1.9	2.8	2.6	2.6	10.4	(a)
15	3.0	3.3	3.5	11.0	2.8	1.65	1.8	2.2	1.95	2.6	7.9	(a)
16	.....	3.35	3.3	12.2	2.7	1.6	1.8	1.9	7.4	2.5	4.9	(a)
17	.....	6.2	3.25	11.95	2.6	1.6	1.7	1.6	9.4	2.5	4.3	(a)
18	3.0	5.3	3.9	10.0	2.7	1.55	1.5	1.5	10.2	2.4	6.1	6.05
19	3.0	7.6	4.4	6.6	2.6	1.5	1.2	1.65	10.6	2.3	9.7	4.1
20	3.0	9.0	3.6	8.6	2.5	1.5	1.2	6.7	11.2	2.4	8.3	7.8
21	3.0	8.7	3.4	5.9	5.9	1.5	1.15	3.0	10.8	2.55	4.9	10.1
22	3.0	7.4	3.25	4.2	4.1	1.45	1.1	2.25	7.6	3.6	4.3	8.7
23	3.0	5.5	3.2	3.6	3.9	1.4	1.1	1.8	3.1	8.2	4.4	10.3
24	3.0	5.45	3.1	3.3	2.6	1.35	.95	1.8	2.6	6.8	4.2	4.9
25	3.0	5.9	3.05	3.1	2.5	5.6	1.0	1.5	2.1	4.0	4.1	4.7
26	3.0	8.9	3.1	3.0	2.45	2.9	.95	1.5	10.7	3.3	4.0	4.2
27	3.0	10.25	5.6	2.9	2.4	2.2	.9	2.4	11.1	3.0	3.4	4.8
28	5.6	9.8	5.3	3.35	2.3	2.45	.85	2.3	13.2	2.8	4.05	7.4
29	7.1	.....	4.3	3.9	2.3	2.3	.8	2.0	13.05	2.8	4.6	5.0
30	6.15	.....	3.6	13.3	.....	2.2	.9	1.7	12.3	2.6	4.9	3.8
31	4.0	.....	3.3	.....	.....	.....	.85	1.6	.....	2.7	.....	.....

[a] Dec. 10 to 17, gage out of order; chain stolen.

NOTE.—Relation of gage height to discharge probably affected by ice about Jan. 3 to 11. Ice reported 3 to 5 inches thick Jan. 4 to 11.

Daily discharge, in second-feet, of Silver Creek near Lebanon, Ill., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	69	253	52	4,030	15	9	0.6	3	814	26	95
2	.....	59	143	49	3,720	14	7	.4	3	665	29	64
3	.....	54	110	49	2,280	13	6	.2	3	712	26	54
4	.....	49	92	157	1,490	12	5	5	2.5	885	26	49
5	.....	45	92	576	915	12	4.5	7	3	2,080	26	45
6	.....	203	92	712	244	12	3	6	244	1,630	56	41
7	.....	150	92	540	110	12	2.5	4	458	860	119	39
8	.....	150	672	164	69	10	2	4.5	187	613	235	39
9	.....	122	814	80	59	8	1.5	23	187	325	129	679
10	.....	92	1,190	59	54	7.5	1.2	29	116	89	69	.....
11	.....	69	885	54	49	7	1	600	92	54	41	.....
12	41	49	652	59	45	6	2	516	320	37	626	.....
13	41	52	179	458	41	5	4	116	98	37	665	.....
14	41	54	80	792	37	5	8	33	26	26	730	.....
15	41	54	64	860	33	5.5	7	14	9	26	415	.....
16	200	56	54	1,400	29	5	7	8	365	23	150	.....
17	150	253	52	1,220	26	5	6	5	588	23	110	.....
18	41	179	86	665	29	4.5	4	4	695	20	244	240
19	41	385	116	289	26	4	2	5.5	770	17	626	98
20	41	540	69	492	23	4	2	298	915	20	458	405
21	41	504	59	227	227	4	1.8	41	814	24	150	679
22	41	365	52	104	98	3.5	1.5	16	385	69	110	504
23	41	195	49	69	86	3	1.5	7	45	447	116	712
24	41	191	45	54	26	2.8	.8	7	26	307	104	150
25	41	227	43	45	23	203	1	4	12	92	98	136

Daily discharge, in second-feet, of Silver Creek near Lebanon, Ill., for 1911—Contd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26	41	528	45	41	22	37	.8	4	792	54	92	104
27	41	704	203	37	20	14	.7	20	885	41	59	143
28	203	639	179	56	17	22	.6	17	2,380	33	95	365
29	335	.....	110	86	17	17	.4	10	2,230	33	129	157
30	248	.....	69	2,480	17	14	.7	6	1,490	26	150	80
31	92	.....	54	.....	16	.....	.6	5	.....	29	.....	140

NOTE.—Daily discharge determined from a discharge rating curve well defined between 29 and 307 second-feet (gage heights 2.7 and 6.8 feet) and fairly well defined between 316 and 1,780 second-feet (gage heights 6.9 and 12.6 feet). Daily discharge Jan. 1 to 11, 16, 17, May 30 to June 4, Dec. 10 to 17, and Dec. 31 estimated by comparison with discharge of Shoal Creek near Breese, Ill., and Cahokia Creek near Poag, Ill. Mean discharge Jan. 1 to 11 estimated about 54 second-feet, varying from about 35 to 90 second-feet. Mean discharge Dec. 10 to 17 estimated about 327 second-feet, varying from about 100 to 600 second-feet.

Monthly discharge of Silver Creek near Lebanon, Ill., for 1911.

[Drainage area, 335 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January [a]	335	.....	77.2	0.230	0.27	D.
February	704	45	216	.645	.67	A.
March	1,190	43	216	.645	.74	A.
April	2,480	37	398	1.19	1.33	B.
May [a]	4,030	16	448	1.34	1.54	C.
June [a]	203	2.8	16.2	.048	.05	D.
July	9	.4	3.07	.0092	.01	D.
August	600	.2	58.6	.175	.20	C.
September	2,380	2.5	471	1.41	1.57	C.
October	2,080	17	326	.973	1.12	C.
November	730	26	197	.588	.66	A.
December [a]	712	39	246	.734	.85	C.
The year	4,030	.2	222	.663	9.01	

[a] See footnotes under table of daily discharge for notes relative to estimates of discharge during period in January, May, June, and December.

BIG MUDDY RIVER NEAR CAMBON, ILL.

Location.—At the Chicago, Burlington & Quincy Railroad bridge about 1 mile north of Cambon station and about 1½ miles east of Plumfield, Ill., in sec. 17, T. 7 S., R. 2 E., about one-fourth mile below the mouth of the Middle Fork

Records available.—June 16, 1908, to December 31, 1911.

Drainage area.—735 square miles.

Gage.—Standard chain gage attached to bridge; datum unchanged.

Channel.—Probably permanent.

Discharge measurements. Made from downstream side of bridge and wooden approach trestles. Low-water measurements are rendered difficult by collections of drift and should be used with caution.

Floods.—Maximum gage height since establishment of the gage is 25.3 feet, which occurred in May, 1911. No records of floods prior to establishment of station are available.

Point of zero flow.—A determination by leveling, October 25, 1911, indicates that there would be no flow past the station if the stream were to fall to about 1.4 feet by the gage datum.

Winter flow.—Ice may affect the relation between gage height and discharge during portions of December, January, and February.

Discharge measurements of Big Muddy River near Cambon, Ill., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Mar. 10	P. S. Monk	10.25	932
Oct. 25	Monk and Brown	2.42	24.3

Daily gage height, in feet, of Big Muddy River near Cambon, Ill., for in 1911.

[Joel Prine, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	9.7	6.55	9.45	4.3	20.25	1.95	1.55	1.75	2.65	12.9	2.5	4.4
2	9.15	5.35	7.65	3.9	24.6	2.05	1.7	2.6	2.4	14.0	2.4	4.4
3	9.8	4.65	7.25	3.6	25.3	2.1	1.65	4.15	2.25	17.7	2.2	4.3
4	9.0	4.0	6.95	3.45	25.05	1.95	1.65	3.85	2.15	13.4	2.1	4.2
5	8.15	3.45	5.85	7.5	24.3	2.1	1.65	6.55	3.2	11.4	2.0	4.1
6	7.6	4.95	5.6	10.0	23.25	2.05	2.95	4.9	5.35	8.3	3.6	4.0
7	6.25	5.25	5.4	11.2	21.9	2.45	2.5	4.0	5.0	6.3	6.7	3.8
8	4.2	6.8	6.45	10.45	20.15	6.75	2.25	3.2	6.15	7.4	10.5	3.5
9	4.0	6.2	9.0	8.0	18.2	6.6	1.75	3.55	6.0	6.6	10.0	3.3
10	3.65	5.65	10.1	5.85	15.8	5.0	1.95	3.0	5.25	6.0	8.4	3.2
11	3.2	5.2	10.9	4.7	12.75	3.8	2.0	2.65	4.6	5.7	6.1	3.3
12	3.85	4.4	8.75	4.2	9.7	3.2	2.3	2.4	3.3	4.6	7.4	3.5
13	3.8	4.1	6.35	6.55	6.95	2.75	2.0	2.25	3.65	4.0	9.6	7.8
14	3.95	3.9	5.2	15.95	4.3	2.45	1.95	2.4	4.2	3.45	11.4	9.2
15	4.9	4.2	4.6	17.9	3.4	2.3	1.65	2.5	4.2	3.5	10.9	9.6
16	4.2	4.8	4.1	20.45	3.0	2.1	1.8	2.2	3.7	3.9	8.8	7.7
17	4.2	6.3	3.75	20.7	2.8	2.0	1.75	2.25	4.3	2.8	6.4	8.7
18	4.2	9.5	3.5	20.2	2.7	2.1	1.75	6.8	4.4	2.7	5.9	10.2
19	3.85	12.9	3.35	19.35	2.55	2.2	1.7	4.55	5.4	2.5	5.4	10.0
20	3.65	14.65	3.25	18.0	2.45	1.9	1.7	3.0	6.6	2.4	5.4	8.6
21	3.6	15.5	3.15	16.6	2.4	1.85	1.7	2.65	6.55	2.4	5.9	9.4
22	3.45	16.45	3.15	15.2	2.4	1.75	1.5	2.3	5.9	2.4	5.5	11.3
23	3.5	17.85	3.1	12.55	2.35	1.85	1.65	2.15	4.25	2.4	5.1	12.2
24	3.5	17.8	3.4	9.1	2.25	2.0	1.7	2.1	4.5	2.4	5.3	12.3
25	3.6	17.2	3.2	6.4	2.2	1.85	1.55	2.4	4.2	2.5	5.6	11.9
26	3.6	16.15	3.5	4.4	2.1	1.8	1.55	2.6	4.0	2.6	5.2	10.4
27	3.8	14.55	3.65	3.8	2.1	1.9	1.55	2.55	10.05	2.5	5.5	7.7
28	5.1	12.25	3.8	3.65	2.05	1.8	1.5	3.2	12.1	2.4	5.2	6.6
29	6.0	.....	5.25	3.65	2.7	1.8	1.35	3.45	11.05	2.8	5.1	6.8
30	6.8	.....	6.2	14.9	2.0	1.6	1.6	2.7	11.0	2.6	4.6	6.6
31	7.35	.....	4.9	.....	2.0	.....	1.6	2.65	.....	2.5	.....	9.2

NOTE.—Relation of gage height to discharge affected by ice about Jan. 3 to 6.

Daily discharge, in second-feet, of Big Muddy River near Cambon, Ill., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	806	318	761	99	5,800	6.5	0.5	2.5	29	1,530	23	104
2	707	181	461	79	10,300	9.5	2	27	20	1,880	20	104
3	700	120	408	67	11,000	11	1.5	92	16	3,770	14	99
4	600	84	370	61	10,700	6.5	1.5	77	12	1,680	11	94
5	450	61	234	441	9,940	11	1.5	318	51	1,160	8	89
6	300	144	206	860	8,840	9.5	41	140	181	558	67	84
7	280	171	186	1,110	7,420	22	23	84	148	286	337	75
8	94	350	304	950	5,720	344	16	51	268	428	960	63
9	84	274	680	510	4,120	324	2.5	65	250	324	860	55
10	69	212	880	234	2,650	148	6.5	43	171	250	574	51
11	51	166	1,050	124	1,490	75	8	29	117	217	262	55
12	77	104	635	94	806	51	17	20	55	117	428	63
13	75	89	292	318	370	33	8	16	69	84	788	482
14	82	79	106	2,720	99	22	6.5	20	94	61	1,160	716
15	140	94	117	3,910	59	17	1.5	23	94	63	1,050	788

Daily discharge, in second-feet, of Big Muddy River near Cambon, Ill., for 1911—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	94	132	89	5,980	43	11	3	14	71	79	644	468
17	94	286	73	6,210	35	8	2.5	16	99	35	298	626
18	94	770	63	5,760	31	11	2.5	350	104	31	239	900
19	77	1,530	57	5,020	25	14	2	114	186	23	186	860
20	69	2,140	53	3,980	22	5	2	43	324	20	186	608
21	67	2,500	49	3,060	20	4	2	29	318	20	239	752
22	61	2,980	49	2,360	20	2.5	.0	17	239	20	196	1,140
23	63	3,880	47	1,430	18	4	1.5	12	96	20	157	1,340
24	63	3,840	59	698	16	8	2	11	110	20	176	1,360
25	67	3,420	51	298	14	4	.5	20	94	23	206	1,270
26	67	2,820	63	104	11	3	.5	27	84	27	166	940
27	75	2,100	69	75	11	5	.5	25	870	23	196	468
28	157	1,350	75	69	9.5	3	.0	51	1,310	20	166	324
29	250	.....	171	69	31	3	.0	61	1,080	35	157	350
30	350	.....	274	2,240	8	1	1	31	1,070	27	117	324
31	422	.....	140	.....	8	.....	1	29	.....	23	.....	716

NOTE.—Daily discharge determined from a discharge rating curve fairly well defined. Daily discharge Jan. 3 to 6 estimated, because of ice, from climatologic records and record of run-off in adjacent drainage areas.

Monthly discharge of Big Muddy River near Cambon, Ill., for 1911.

[Drainage area, 735 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January [a]	806	51	212	0.288	0.33	C.
February	3,880	61	1,080	1.47	1.53	B.
March	1,050	47	262	.356	.41	B.
April	6,210	61	1,630	2.22	2.48	B.
May	11,000	8	2,570	3.50	4.04	B.
June	344	1	39.2	.053	.06	C.
July	41	.0	5.10	.0069	.008	D.
August	350	2.5	59.9	.081	.09	C.
September	1,310	12	254	.346	.39	B.
October	3,770	20	415	.565	.65	B.
November	1,160	8	330	.449	.50	B.
December	1,360	51	496	.675	.78	B.
The year	11,000	0	609	.829	11.27	

[a] See footnotes to table of daily discharge.

BEAUCOUP CREEK NEAR PINCKNEYVILLE, ILL.

Location.—At Illinois Central Railroad bridge about 1½ miles east of Pinckneyville, Ill., about 10 miles above the mouth of Galum Creek.

Records available.—June 17, 1908, to December 31, 1911. During 1908 the gage was read only when the observer happened to be in the vicinity. Except for a few days, however, fairly accurate results will be obtained if the discharge is interpolated on days when gage was not read.

Drainage area.—227 square miles.

Gage.—Standard chain gage attached to bridge; datum unchanged.

Channel.—Probably permanent; poor for low-water measurements because of low velocity and old piles in channel.

Discharge measurements.—Made from downstream side of wooden trestle. Low-water measurements made at wading section about 250 yards upstream.

Floods.—The flood of 1902 reached a height of about 27.5 feet on the present gage.

Winter flow.—Ice affects the relation between gage height and discharge during portions of December, January, and February.

Remarks.—The creek goes dry at times, the water then standing in pools near the gage.

Discharge measurements of Beaucoup Creek near Pinckneyville, Ill., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Mar. 11	P. S. Monk	4.31	95.4
Oct. 24	Monk and Brown	2.68	[a] 18.2

[a] Oct. 24, measurement made by wading one-half mile above regular section.

Daily gage height, in feet, of Beaucoup Creek near Pinckneyville, Ill., for 1911.

[R. C. Huggins, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept	Oct.	Nov.	Dec.
1	4.0	2.3	3.7	2.85	21.05	2.0	1.95	2.0	2.4	3.8	2.25	3.0
2	3.8	2.3	4.4	2.8	20.0	2.0	.....	1.95	2.4	.....	2.2	2.85
3	4.35	2.8	4.6	2.7	14.5	2.0	1.95	5.15	.....	6.0	2.2	2.7
4	3.7	2.7	4.25	2.8	8.5	.....	1.95	.....	.....	3.7	2.15	2.6
5	3.2	.....	3.9	5.6	4.3	2.0	1.9	5.25	.....	.....	2.15	2.55
6	2.8	2.8	3.7	5.6	3.65	2.0	1.9	.....	4.95	3.0	4.5	2.5
7	2.65	2.95	3.85	4.0	.....	2.0	1.9	2.9	7.5	.....	4.4	2.5
8	2.55	3.1	8.3	3.0	3.0	2.0	1.9	4.0	.....	.....	5.4	2.5
9	2.5	3.0	.....	3.0	2.9	2.0	.....	4.2	.....	3.05	3.05	2.6
10	2.5	2.1	4.9	2.8	2.8	2.0	1.85	2.7	3.3	.....	3.0	4.8
11	2.5	2.75	4.35	.....	2.8	1.95	1.85	2.65	3.45	.....	2.8	5.9
12	2.5	2.65	3.9	2.7	2.6	1.9	1.95	2.6	2.8	2.05	3.15	6.0
13	2.5	2.6	3.55	10.5	2.5	1.9	1.95	.....	3.0	2.5	5.2	4.3
14	2.6	2.6	3.15	16.0	2.5	1.9	1.95	2.25	2.7	2.4	4.75	3.3
15	2.6	2.6	.....	17.7	2.5	.....	1.9	2.15	2.45	2.35	3.9	.....
16	2.6	2.9	2.8	7.4	2.5	1.9	1.95	2.1	2.7	2.35	3.2	5.0
17	2.6	3.5	2.7	4.4	2.4	1.9	1.95	2.0	3.45	.....	2.3	5.6
18	2.6	4.35	2.6	3.9	2.4	.....	1.9	2.0	5.85	2.3	2.3	3.5
19	2.5	.....	2.6	7.4	2.4	2.2	1.9	1.95	8.9	2.3	3.2	3.3
20	2.55	15.0	2.6	8.6	2.4	2.0	1.9	.....	3.9	2.25	3.2	.....
21	2.5	12.0	2.6	5.0	.....	2.0	2.0	1.9	.....	2.25	3.1	6.8
22	2.5	5.65	2.6	3.95	2.3	2.0	1.95	1.9	.....	2.6	2.9	8.85
23	2.6	4.95	.....	.....	2.3	2.0	.....	1.9	3.9	2.4	2.85	5.85
24	2.55	4.6	1.85	3.0	2.6	2.0	1.95	.....	.....	2.4	2.8	4.85
25	2.6	5.55	1.9	2.85	2.5	2.0	1.9	2.2	2.5	2.9	2.85	3.7
26	2.6	6.3	.....	2.8	2.4	2.0	1.9	2.2	6.25	2.7	3.6	3.5
27	2.6	6.1	3.45	.....	2.3	2.0	1.9	.....	9.0	2.55	3.1	3.3
28	4.6	4.5	3.5	2.75	2.15	2.0	1.9	2.4	5.0	2.4	3.0	4.1
29	.....	.....	3.85	7.05	2.2	2.0	1.9	.....	3.7	2.4	2.8	3.4
30	4.3	.....	3.15	19.05	2.0	2.0	.....	2.5	3.1	2.4	.....	4.3
31	3.6	.....	3.0	.....	2.0	.....	1.95	2.4	.....	2.4	.....	.....

NOTE.—Relation of gage height to discharge affected by ice, Jan. 3 to 9.

Daily discharge, in second-feet, of Beaucoup Creek near Pinckneyville, Ill., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	80	8	65	26	2,170	3	3	3	11	70	7	32
2	70	8	105	24	2,020	3	3	3	11	148	6	26
3	50	24	119	20	1,250	3	3	159	11	227	6	20
4	40	20	95	24	468	3	3	163	11	65	5	17
5	30	20	75	195	98	3	3	167	20	48	5	16
6	25	24	65	195	62	3	3	98	144	32	112	14
7	20	30	72	80	42	3	3	28	363	33	105	14
8	20	36	446	32	32	3	3	80	300	33	179	14
9	15	32	500	32	28	3	3	92	200	34	34	17
10	14	4	140	24	24	3	2.5	20	45	24	32	133
11	14	22	102	22	24	3	2.5	18	52	14	24	219
12	14	18	75	20	17	3	3	17	24	3.5	38	227
13	14	17	58	705	14	3	3	12	32	14	163	98
14	17	17	38	1,460	14	3	3	7	20	11	130	45
15	17	17	31	1,700	14	3	3	5	12	9.5	75	96
16	17	28	24	353	14	3	3	4	20	9.5	40	147
17	17	55	20	105	11	3	3	3	52	8.8	8	195
18	17	102	17	75	11	4	3	3	215	8	8	55
19	14	1,200	17	353	11	6	3	3	512	8	40	45
20	16	1,320	17	479	11	3	3	3	75	7	40	172
21	14	900	17	147	10	3	3	3	75	7	36	299
22	14	199	17	78	8	3	3	3	75	17	28	506
23	17	144	9.8	55	8	3	3	3	75	11	26	215
24	16	119	2.5	32	17	3	3	4	45	11	24	136
25	17	191	3	26	14	3	3	6	14	28	26	65
26	17	254	30	24	11	3	3	6	250	20	60	55
27	17	236	52	23	8	3	3	8	523	16	36	45
28	119	112	55	22	5	3	3	11	147	11	32	86
29	108	.....	72	322	6	3	3	12	65	11	24	50
30	98	.....	38	1,890	3	3	3	11	36	11	28	98
31	60	.....	32	.....	3	.....	3	11	.....	11	.....	185

NOTE.—Daily discharge determined from a discharge rating curve well defined between 8 and 227 second-feet (gage heights 2.3 and 6 feet), and fairly well defined between 236 and 640 second-feet (gage heights 6.1 and 10 feet). Daily discharge Jan. 3 to 9 estimated, because of ice, from climatologic and run-off records in adjacent drainage areas and gage observer's notes. Daily discharge interpolated or estimated from climatologic records and run-off in adjacent drainage areas on days when gage was not read.

Monthly discharge of Beaucoup Creek near Pinckneyville, Ill., for 1911.

[Drainage area, 227 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	119	14	32.8	0.144	0.17	C.
February	1,320	4	184	.811	.84	B.
March	500	2.5	77.7	.342	.39	A.
April	1,890	20	285	1.26	1.41	B.
May	2,170	3	207	.912	1.05	B.
June	6	3	3.1	.014	.02	D.
July	3	2.5	3.0	.013	.01	D.
August	167	3	31.3	.138	.16	C.
September	523	11	114	.502	.56	B.
October	227	3.5	31.0	.137	.16	B.
November	179	5	45.9	.202	.23	A.
December	506	14	102	.450	.52	A.
The year	2,170	2.5	92.2	.406	5.52	

NOTE.—See footnotes to tables of daily gage height and daily discharge for notes relative to discharges estimated.

MISCELLANEOUS MEASUREMENTS.

HUDSON BAY DRAINAGE BASIN.

Miscellaneous measurements in St. Mary River (Montana) drainage basin in 1911.

[By W. A. Lamb and B. E. Jones.]

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.	Drainage area.	Discharge per square mile.
				Feet.	*Sec.-ft.*	*Sq. miles.*	*Sec.-ft.*
Dec. 6	Swiftcurrent Creek.	St. Mary River	McDermott Lake, near Babb, Mont.[a]		19.1	32	0.597
May 5	Kennedy Creek	do	Babb, Mont.[b]		171		
July 18	do	do	do.[b]		153		
Aug. 26	do	do	do.[b]		81		
Oct. 12	do	do	do.[b]		94		

[a] Dec. 6. Measurement made by wading about 200 feet below the falls at the outlet of McDermott Lake. Gage height not referenced.
[b] Measurements made by wading near the ford. Gage heights not referenced.

Miscellaneous measurements in Red River drainage basin in 1911.

[By E. F. Chandler, Goric Monley, and George Ebner.]

Mar. 4	Red Lake River.	Red River	Mouth, East Grand Forks, Minn.	[a] 4.54	134	5,760	0.023
May 13	do	do	do	7.20	360	5,760	.063
July 18	do	do	do	3.83	173	5,760	.030
June 28	Roseau River	do	Near Roseau City, Minn.	2.50	28.9		
Sept. 14	do	do	do	1.89	3.2		
June 27	East Branch of Roseau River.	Roseau River	Near Malone, Minn.	1.52	17.9		
Sept. 13	do	do	do	.92	2.3		

[a] Mean lower surface of ice=2.10 feet.

Miscellaneous measurements in Rainy River drainage basin in 1911.

[By Robert Follansbee, C. R. Adams, and C. J. Emerson.]

Feb. 2	Little Fork River.	Rainy River	Tps. 62-63, R. 21 W., near Hughes, Minn.		36		
June 18	Vermilion River.	do	Crane Lake, Portage, Minn.	3.0	652		

UPPER MISSISSIPPI RIVER DRAINAGE BASIN.

Miscellaneous measurements in upper Mississippi River drainage basin in 1911.

[By Robert Follansbee and G. L. Rosing.]

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.	Drainage area.	Discharge per square mile.
				Feet.	*Sec.-ft.*	*Sq. miles.*	*Sec.-ft.*
Aug. 20	Prairie River	Mississippi River	Near Grand Rapids, Minn.	8.17	96		
July 7	Yellow Medicine River.	Minnesota River	Hanley Falls, Minn.		10.7		

SUMMARY OF MEAN DISCHARGE PER SQUARE MILE.

The following summary of discharge per square mile is given to allow ready comparison of relative rates of run-off from different areas in the Hudson Bay and upper Mississippi drainage basins. It shows in a general way the seasonal distribution of run-off, and the effect of snow, ground, surface, and artificial storage. The most important fact worth noting is the almost entire lack of uniformity or agreement between any two streams, which indicates that the discharge of each stream is a law unto itself, and that all projects dependent upon stream flow, if they are to be developed along the safest and most economical lines, must be based on records of stream flow collected with great care over a long series of years as near the location of the project under consideration as possible.

Summary of discharge, in second-feet per square mile, in Hudson Bay and upper Mississippi River basins for 1911.

Station.	Drainage area.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
	Sq.mi.													
St. Mary River near Babb, Mont	177	0.48	0.44	0.43	0.87	5.58	11.0	5.60	2.99	3.39	1.87	0.73	0.30	2.81
St. Mary River below Swiftcurrent Creek, at Babb, Mont	298	.52	.47	.44	1.20	5.64	10.2	5.37	2.78	3.42	1.60	.70	.33	2.72
St. Mary River near Cardston, Alberta, Canada	452	.38	.33	.32	1.06	4.51	7.68	3.72	2.32	2.79	1.37	.76	.43	2.14
Otter Tail River near Fergus Falls, Minn.	1,310	.06	.06	.10	.18	.17	.13	.08	.10	.10	.12	.10	.08	.11
Red River at Fargo, N. Dak	6,020	....	....	.04	.06	.05	.04	.02	.03	.03	.04	....	....	....
Red River at Grand Forks, N. Dak	25,000	.01	.01	.03	.08	.06	.07	.02	.02	.02	.02	.02	.01	.03
Pelican River near Fergus Falls, Minn.	433	(a)	(a)	.02	.09	.08	.08	.03	.04	.04	.08	.05	.02	.04
Wild Rice River at Twin Valley, Minn.	805	.03	.02	.09	.30	.25	.13	.16	.04	.03	.17	.04	.04	.11
Red Lake River at Thief River Falls, Minn	3,430	.04	.03	.04	.11	.08	.18	.02	.01	.01	.01	(a)	(a)	.04
Red Lake River at Crookston, Minn	5,320	.03	.02	.08	.12	.08	.18	.03	.02	.02	.02	.01	.02	.05
Thief River near Thief River Falls, Minn	1,010	.00	.00	.01	.05	.01	.01	(a)	(a)	(a)	(a)	(a)	.00	.01
Clearwater River at Red Lake Falls, Minn	1,310	.03	.03	.04	.18	.07	.14	.02	.05	.04	.04	....	....	....
South Branch of Two Rivers at Hallock, Minn	776	....	....	....	....	.06	.42	.04	.01	.02	.06	.02	.01	....
Pembina River at Neche, N. Dak	2,940	....	....	....	.10	.08	.05	.02	.01	(a)	.01	....	....	....
West Branch of Roseau River near Malung, Minn	265	....	....	....	....	....	.34	.02	.01	.01	.01	.01	.01	....
Mouse River at Minot, N. Dak	8,400	....	....	....	.04	.05	.02	(a)	(a)	(a)	(a)	(a)	(a)	....
Rainy River at International Falls, Minn	14,600	.20	.16	.17	.25	.32	.43	.27	.45	.41	.36	.37	.40	.32
Little Fork River at Little Fork, Minn.	1,720	....	....	....	1.22	.63	.98	.12	.29	.31	.21	.12	.08	....
Vermilion River below Lake Vermilion, Minn	507	....	....	....	....	....	1.04	.61	.47	.39	.30	.24	.26	....
Mississippi River above Sandy River, Minn	4,510	.15	.15	.19	.27	.38	.44	.56	.41	.50	.34	.25	.14	.32
Mississippi River at Anoka, Minn	17,100	.10	.10	.14	.20	.26	.27	.23	.21	.24	.25	.18	.12	.19
Mississippi River at St. Paul, Minn	35,700	.06	.06	.09	.12	.15	.16	.12	.12	.12	.23	.12	.09	.12
Pine River below Pine River reservoir, Minn	452	.19	.22	.24	.28	.80	.84	.63	.30	.21	.10	.12	.12	.34
Crow Wing River at Nimrod, Minn	1,010	....	....	....	.20	.18	.52	.22	.19	.43	.45	.46	....	....
Crow Wing River at Pillager, Minn	3,230	.12	.11	.17	.21	.19	.23	.12	.13	.18	.26	.16	.14	.17
Long Prairie River near Motley, Minn.	973	....	....	....	.13	.13	.10	.06	.08	.12	.19	....	....	....
Sauk River near St. Cloud, Minn	816	.02	.01	.14	.09	.08	.07	.09	.11	.13	.11	.13	.16	.10
Elk River near Big Lake, Minn	615	....	....	....	....	.22	.17	.10	.13	.14	.29	.18	.18	....
Crow River at Rockford, Minn	2,520	.02	.02	.05	.07	.09	.09	.04	.04	.04	.17	.06	.06	.06
South Branch of Crow River near Rockford, Minn	1,170	....	....	.06	.07	.08	.02	.01	.01	.01	.17	.04	.03	....
Rum River at Onamia, Minn	414	.00	.00	(a)	.02	.01	.02	.01	(a)	.01	.03	.03	.01	.01
Rum River at Cambridge, Minn	1,160	.04	.05	.10	.10	.20	.28	.18	.14	.10	.25	.11	.10	.14

[a] Discharge per square mile less than 0.005 second-foot.

Summary of discharge, in second-feet per square mile, in Hudson Bay and upper Mississippi River basins for 1911—Continued.

Station.	Drainage area.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
	Sq.mi.													
Minnesota River near Odessa, Minn.	1,560	....	....	....	.03	.01	.01	(a)	(a)	.01	.02	....	....	....
Minnesota River near Montevideo, Minn.	6,300	.01	.01	.04	.04	.03	.03	.01	.01	.01	.03	.03	.02	.02
Minnesota River near Mankato, Minn.	14,600	.01	.01	.05	.05	.04	.03	.02	.02	.01	.12	.07	.05	.04
Lac qui Parle River at Lac qui Parle, Minn.	838	....	....	....	.04	.01	.01	(a)	(a)	(a)	.03	.02	....	....
Chippewa River near Watson, Minn.	1,940	....	....	....	.04	.03	.06	.01	.01	.02	.05	.04	.01	....
Redwood River near Redwood Falls, Minn.	703	....	....	....	.04	.02	.01	(a)	.01	.01	.07	.02	.02	....
Cottonwood River near New Ulm, Minn.	1,190	....	....	....	.05	.02	.01	(a)	.02	.02	.23	.05	.05	....
St. Croix River near St. Croix Falls, Wis.	5,930	.20	.24	.39	.58	.68	.54	.30	.30	.36	.65	.34	.34	.41
Kettle River near Sandstone, Minn.	825	.08	.09	.21	.72	1.05	.68	.50	.33	.44	.49	.25	.18	.42
Snake River at Mora, Minn.	422	.02	.04	.11	.19	.34	.54	.23	.14	.43	.51	.19	.13	.24
Cannon River at Welch, Minn.	1,290	....	....	.12	.11	.10	.14	.09	.17	.17	1.29	.39	.47	....
Zumbro River at Zumbro Falls, Minn.	1,120	.14	.46	.22	.18	.22	.17	.11	.31	.14	1.34	.31	.51	.34
South Branch of Zumbro River near Zumbro Falls, Minn.	821	....	....	....	....	....	....	.10	.30	.12	1.35	.33	.53	....
Root River near Houston, Minn.	1,560	.20	.54	.25	.23	.28	.24	.18	.76	.30	.92	.34	.56	.40
North Branch of Root River near Lanesboro, Minn.	647	....	....	.21	.19	.29	.19	.10	1.53	.28	1.54	.42	.71	....
Wapsipinicon River at Stone City, Iowa.	1,310	....	....	.27	.22	.30	.30	.07	.66	.20	.76	.40	.51	....
Cedar River near Austin, Minn.	425	.10	.43	.13	.12	.16	.13	.05	.60	.07	1.29	.28	.48	.32
Cedar River at Cedar Rapids, Iowa	6,320	.06	.62	.24	.17	.28	.26	.08	.34	.18	.57	.27	.34	.28
Des Moines River at Jackson, Minn	1,160	....	....	....	.04	.03	.02	.02	.04	.04	.13	.06	.05	....
Sangamon River at Monticello, Ill	550	1.00	.58	.48	1.22	.32	.05	.01	.01	.59	.95	1.33	.91	.62
Sangamon River at Riverton, Ill	2,560	1.14	.88	.64	1.40	.56	.13	.05	.06	1.02	2.45	1.28	.94	.88
Sangamon River near Oakford, Ill	5,000	.96	.73	.55	1.01	.44	.16	....	....	....	....	....	....	....
South Fork of Sangamon River near Taylorville, Ill.	427	1.50	.90	.67	1.46	.62	.14	.04	.04	1.13	1.92	1.10	.86	.86
Salt Creek near Kenney, Ill.	459	1.61	.55	.43	.85	.23	.06	.02	.01	1.53	1.28	1.18	.91	.72
Cahokia Creek near Poag, Ill.	259	.44	.78	.64	1.18	1.08	.07	.05	.31	1.12	1.47	.82	.86	.73
Kaskaskia River near Arcola, Ill.	390	1.21	.95	.96	2.28	.65	.08	.00	.01	1.03	1.83	1.24	.66	.91
Kaskaskia River at Shelbyville, Ill	1,030	1.60	1.36	.99	2.36	.64	.10	.02	.02	1.41	2.86	1.46	.85	1.14
Kaskaskia River at Vandalia, Ill	1,980	1.10	1.12	.90	1.54	.69	.06	.03	.01	1.00	2.37	.91	.85	.88
Kaskaskia River at Carlyle, Ill	2,680	.80	1.02	.87	1.41	.76	.08	.02	.02	.63	2.52	1.04	.77	.83
Kaskaskia River at New Athens, Ill	5,220	.46	.92	.90	1.34	1.50	.08	.05	.05	.59	2.13	.86	.72	.80
Shoal Creek near Breese, Ill.	760	.38	1.03	.78	1.03	.83	.10	.08	.13	.93	1.68	.72	.69	.70
Silver Creek near Lebanon, Ill.	335	.23	.64	.64	1.19	1.34	.05	.01	.18	1.41	.97	.59	.73	.66
Big Muddy River near Cambon, Ill.	735	.29	1.47	.36	2.22	3.50	.05	.01	.08	.35	.56	.45	.68	.83
Beaucoup Creek near Pinckneyville, Ill.	227	.14	.81	.34	1.26	.91	.01	.01	.14	.50	.14	.20	.45	.41

[a] Discharge per square mile less than 0.005 second-foot.

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SURFACE WATER SUPPLY OF THE UNITED STATES

1911

PART VI. MISSOURI RIVER BASIN

PREPARED UNDER THE DIRECTION OF M. O. LEIGHTON

BY

W. A. LAMB, W. B. FREEMAN, AND
RAYMOND RICHARDS

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SURFACE WATER SUPPLY OF THE MISSOURI RIVER BASIN, 1911.

By W. A. Lamb, W. B. Freeman, and Raymond Richards.

AUTHORITY FOR THE WORK.

This volume is Part VI of a series of 12 reports presenting results of measurements of flow made on certain streams in the United States during the calendar year 1911. The reports are listed in the following table:

Papers on surface water supply of the United States, 1911.

Part.[a]	No.	Title.
I	301	North Atlantic coast.
II	302	South Atlantic coast and eastern Gulf of Mexico.
III	303	Ohio River basin.
IV	304	St. Lawrence River basin.
V	305	Upper Mississippi River and Hudson Bay basins.
VI	306	Missouri River basin.
VII	307	Lower Mississippi River basin.
VIII	308	Western Gulf of Mexico.
IX	309	Colorado River basin.
X	310	Great Basin.
XI	311	Pacific coast in California.
XII	312	North Pacific coast.

[a] For the purpose of uniformity in the presentation of reports, a general plan has been agreed upon by the United States Reclamation Service, the United States Forest Service, the United States Weather Bureau, and the United States Geological Survey, according to which the area of the United States has been divided into 12 parts, whose boundaries coincide with natural drainage lines indicated by the parts of the report.

The data presented in these reports were collected by the United States Geological Survey under authority implied in the organic law (20 Stat. L., p. 394), which contains the following paragraph:

Provided, That this officer [the Director] shall have the direction of the geological survey and the classification of public lands and examination of the geological structure, mineral resources, and products of the national domain.

The work was begun in 1888 in connection with special studies of water supply for irrigation.

Since the fiscal year ending June 30, 1895, successive sundry civil bills passed by Congress have carried the following item and appropriations:

For gaging the streams and determining the water supply of the United States and for the investigation of underground currents and artesian wells and for the preparation of reports upon the best methods of utilizing the water resources.

Annual appropriations for the fiscal year ending June 30—

1895	$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911 to 1913, inclusive	150,000

In the execution of the work many private and State organizations have cooperated. Acknowledgments for such cooperation are made on pages 13–14, and also in connection with the description of each station affected by the cooperative work.

PUBLICATIONS.

Measurements of stream flow have been made at nearly 2,000 points in the United States, and also at many points in small areas in Seward Peninsula and the Yukon-Tanana region, Alaska, and in the Hawaiian Islands. During 1911 gaging stations were maintained by the Survey and the cooperating organizations at about 1,500 points in the United States, and many discharge measurements were made at other points. In connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country, and will be made available in the regular surface water supply papers from time to time. A complete list of the gaging stations maintained by the Survey to and including 1910, and a list of the papers relating to the water supply of the country, have been published by the Survey as Water-Supply Paper 280. An index to the reports containing stream-flow measurements prior to 1904 has been published as Water-Supply Paper 119.

For each calendar year there has been prepared a report embodying the stream-flow data collected during that year, which has been published either as a part of the Annual Report of the Director, as a bulletin, or as a water-supply paper, as shown by the following table:

Stream-flow data in reports of the United States Geological Survey.

[A=Annual Report; B=Bulletin; WS=Water-Supply Paper.]

Report.	Character of data.	Year.
10th A, pt. 2	Descriptive information only	
11th A, pt. 2	Monthly discharge	1884 to Sept., 1890.
12th A, pt. 2	do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and rating	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
WS 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, mesurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
WS 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
WS 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
WS 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.

Stream-flow data in reports of the United States Geological Survey—Continued.

Report.	Character of data.	Year.
WS 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
WS 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
WS 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A, pt. 4	Monthly discharge	1900.
WS 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
WS 75	Monthly discharge	1901.
WS 82 to 85	Complete data	1902.
WS 97 to 100	do	1903.
WS 124 to 135	do	1904.
WS 165 to 178	do	1905.
WS 201 to 214	Complete data, except descriptions	1906.
WS 241 to 252	Complete data	1907–8.
WS 261 to 272	do	1909.
WS 281 to 292	do	1910.
WS 301 to 312	do	1911.

NOTE.—No data regarding stream flow are given in the 15th and 17th annual reports.

The table which follows gives, by years and drainage basins, the numbers of the papers on surface water supply published from 1899 to 1911. The data for any particular station will be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Me., 1903 to 1911, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, and 301, which contain records for the New England streams from 1903 to 1911.

Numbers of water-supply papers containing results of stream measurements, 1899–1911.

	1899 [a]	1900 [b]	1901	1902	1903	1904
North Atlantic Coast (St. John River to York River)	35	47, [c] 48	65, 75	82	97	[d] 124, [e] 125, [f] 126
South Atlantic Coast and Eastern Gulf of Mexico (James River to the Mississippi)	[g] 35, 36	48	65, 75	[g] 82, 83	[g] 97, 98	[f] 126, 127
Ohio River Basin	36	48, [h] 49	65, 75	83	98	128
St. Lawrence River and Great Lakes	36	49	65, 75	[i] 82, 83	97	129
Hudson Bay and Upper Mississippi River	36	49	[j] 65, 66, 75	[j] 83, 85	[j] 98, 99, 100	[j] 128, 130
Missouri River	[k] 36, 37	49, [l] 50	66, 75	84	99	130, [m] 131
Lower Mississippi River	37	50	[j] 65, 66, 75	[j] 83, 84	[j] 98, 99	[j] 128, 131
Western Gulf of Mexico	37	50	66, 75	84	99	132
Colorado River	[n] 37, 38	50	66, 75	85	100	133
Great Basin	38, [o] 39	51	66, 75	85	100	133, [p] 134
Pacific Coast in California	38, [q] 39	51	66, 75	85	100	134
North Pacific Coast	38	51	66, 75	85	100	135

[a] Rating tables and index to Water-Supply Papers 35–39 continued in Water-Supply Paper 39.
[b] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52.
[c] Wissahickon and Schuylkill rivers to James River.
[d] New England rivers only.
[e] Hudson River to Delaware River, inclusive.
[f] Susquehanna River to Yadkin River, inclusive.
[g] James River only.
[h] Scioto River.
[i] Lake Ontario and tributaries to St. Lawrence River proper.
[j] Tributaries of Mississippi from east.
[k] Gallatin River.
[l] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.
[m] Platte and Kansas rivers.
[n] Green and Gunnison rivers and Grand River above junction with Gunnison.
[o] Mohave River only.
[p] Great Basin in California, excepting Truckee and Carson drainage basins.
[q] Kings and Kern rivers and south Pacific coast drainage basins.

Numbers of water-supply papers containing results of stream measurements, 1899–1911—Continued.

	1905	1906	1907–8	1909	1910	1911
North Atlantic coast (St. John River to York River)	[a] 165, [b] 166, [c] 167	[a] 201, [b] 202, [c] 203	241	261	281	301
South Atlantic Coast and Eastern Gulf of Mexico (James River to the Mississippi)	[c] 167, 168	[c] 203, 204	242	262	282	302
Ohio River Basin	169	205	243	263	283	303
St. Lawrence River and Great Lakes	170	206	244	264	284	304
Hudson Bay and upper Mississippi River	171	207	245	265	285	305
Missouri River	172	208	246	266	286	306
Lower Mississippi River	[d] 169, 173	[d] 205, 209	247	267	287	307
Western Gulf of Mexico	174	210	248	268	288	308
Colorado River	175, [e] 177	211	249	269	289	309
Great Basin	176, [f] 177	212, [f] 213	250, [f] 251	270, [f] 271	290	310
Pacific coast in California	177	213	251	271	291	311
North Pacific coast	[g] 177, 178	214	252	272	292	312

[a] New England rivers only.
[b] Hudson river to Delaware River, inclusive.
[c] Susquehanna River to Yadkin River, inclusive.
[d] Tributaries of Mississippi from east.
[e] Below junction with Gila.
[f] Great Basin in California, excepting Truckee and Carson dainage basins.
[g] Rogue, Umpqua, and Siletz rivers only.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups—(1) those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and discharge in second-feet per square mile, and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. The units used in this series of reports are second-feet, second-feet per square mile, run-off depth in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the unit for the rate of discharge of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the following table of equivalents.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off, depth in inches," is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

An "acre-foot" is equivalent to 43,560 cubic feet and is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation work.

CONVENIENT EQUIVALENTS.

The following is a list of convenient equivalents for use in hydraulic computations:

Table for converting discharge in second-feet per square mile into run-off in depth in inches over the area.

Discharge in second-feet per square mile.	Run-off in inches.				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.03719	1.041	1.079	1.116	1.153
2	.07438	2.083	2.157	2.231	2.306
3	.11157	3.124	3.236	3.347	3.459
4	.14876	4.165	4.314	4.463	4.612
5	.18595	5.207	5.393	5.578	5.764
6	.22314	6.248	6.471	6.694	6.917
7	.26033	7.289	7.550	7.810	8.070
8	.29752	8.331	8.628	8.926	9.223
9	.33471	9.372	9.707	10.041	10.376

NOTE.—For partial month multiply the values for one day by the number of days.

Table for converting discharge in second-feet into run-off in acre-feet.

Discharge in second-feet	Run-off in acre-feet.				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	1.983	55.54	57.52	59.50	61.49
2	3.967	111.1	115.0	119.0	123.0
3	5.950	166.6	172.6	178.5	184.5
4	7.934	222.1	230.1	238.0	246.0
5	9.917	277.7	287.6	297.5	307.4
6	11.90	333.2	345.1	357.0	368.9
7	13.88	388.8	402.6	416.5	430.4
8	15.87	444.3	460.2	476.0	491.9
9	17.85	499.8	517.7	535.5	553.4

NOTE.—For partial month multiply the values for one day by the number of days.

1 second-foot equals 40 California miner's inches (law of March 23, 1901).

1 second-foot equals 38.4 Colorado miner's inches.

1 second-foot equals 40 Arizona miner's inches.

1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,317 gallons for one day.

1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.

1 second-foot for one year equals 31,536,000 cubic feet.

1 second-foot equals about 1 acre-inch per hour.

1 second-foot for one day equals 86,400 cubic feet.

1,000,000,000 (1 United States billion) cubic feet equals 11,570 second-feet for 1 day.

1,000,000,000 cubic feet equals 414 second-feet for one 28-day month.

1,000,000,000 cubic feet equals 399 second-feet for one 29-day month.

1,000,000,000 cubic feet equals 386 second-feet for one 30-day month.

1,000,000,000 cubic feet equals 373 second-feet for one 31-day month.

100 California miner's inches equals 18.7 United States gallons per second.

100 California miner's inches for one day equals 4.96 acre-feet.

100 Colorado miner's inches equals 2.60 second-feet.

100 Colorado miner's inches equals 19.5 United States gallons per second.

100 Colorado miner's inches for one day equals 5.17 acre-feet.

100 United States gallons per minute equals 0.223 second-foot.
100 United States gallons per minute for one day equals 0.442 acre-foot.
1,000,000 United States gallons per day equals 1.55 second-feet.
1,000,000 United States gallons equals 3.07 acre-feet.
1,000,000 cubic feet equals 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
$1\frac{1}{3}$ horsepower equals about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel realizing 80 per cent of theoretical power.

EXPLANATION OF DATA.

For each regular current meter gaging station the following data, so far as available, are given: Description of the station, list of discharge measurements, table of daily gage heights, table of daily discharge, table of monthly and yearly discharges and run-off. For stations located at weirs or dams the gage-height table is omitted.

In addition to statements regarding the location and installation of current-meter stations, the descriptions give information in regard to any conditions which may affect the constancy of the relation of gage height to discharge, covering such points as ice, logging, shifting channels, and backwater; also information regarding diversions which decrease the total flow at the measuring section. Statements are also made regarding the accuracy and reliability of the data.

The table of daily gage heights records the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day, usually in the morning and in the evening. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. All gage heights affected by the presence of ice in the streams or by backwater from obstructions are published as recorded, with suitable footnotes. The rating table is not applicable for such periods unless the proper corrections to the gage heights are known and applied. Attention is called to the fact

MAP OF UNITED STATES, SHOWING MEAN ANNUAL PRECIPITATION

Blue lines and figures indicate average annual precipitation in depth in inches

Prepared by Henry Gannett
mainly from data of the
United States Geological Survey
and United States Weather Bureau

that the zero of the gage is placed at an arbitrary datum and has no relation to zero flow or the bottom of the river. In general, the zero is located somewhat below the lowest known flow, so that negative readings shall not occur.

The discharge measurements and gage heights are the base data from which rating tables, daily discharge tables, and monthly discharge tables are computed.

The rating table gives, either directly or by interpolation, the discharge in second-feet corresponding to every stage of the river recorded during the period for which it is applicable. It is not published in this report, but can be determined from the tables of daily gage heights and daily discharge as follows:

First plot the discharge measurements for the current and earlier years on cross-section paper, with gage heights in feet as ordinates and discharge in second-feet as abscissas. Then tabulate a number of gage heights taken from the daily gage-height table for the complete range of stage given and the corresponding discharges for the days selected from the daily discharge table and plot the values on cross-section paper. The last points plotted will define the rating curve used and will lie among the plotted discharge measurements. After drawing the rating curve, a table can be developed by scaling off the discharge in second-feet for each tenth foot of gage height. These values should be so adjusted that the first differences shall always be increasing or constant, except for known backwater periods.

The table of daily discharge gives the discharge in second-feet corresponding to the observed gage heights as determined from the rating tables.

In the table of monthly discharge the column headed "Maximum" gives the mean flow, as determined from the rating table, for the day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the stage when the water surface was at crest height, and the corresponding discharge was consequently larger than given in the maximum column. Likewise, in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this the computations for the remaining columns, which are defined on page 12, are based.

The field methods used in the collection of the data presented in this series of reports are described in the introductory sections of Water-Supply Papers 261 to 272, inclusive, "Surface water supply of the United States, 1909." Plates I and II show the average precipitation and run-off in the United States as determined from the measurements of stream flow made by the Geological Survey and

records of rainfall collected by the Weather Bureau; Plate III shows typical gaging stations; Plate IV shows current meters [1] used in the work.

ACCURACY AND RELIABILITY OF FIELD DATA AND COMPARATIVE RESULTS.

The accuracy of stream-flow data depends primarily on the natural conditions at the gaging station and on the methods and care with which the data are collected. Errors of the first group depend on the degree of permanency of channel and of permanency of the relation between discharge and stage.

Errors of the second class are due, first, to errors in observation of stage; second, to errors in measurements of flow; and, third, to errors due to misinterpretation of stage and flow data.

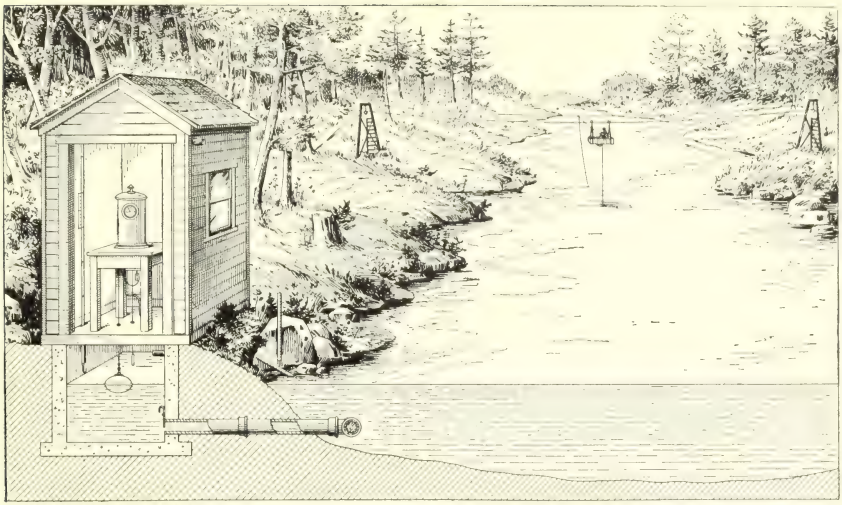
In order to give engineers and others information regarding the probable accuracy of the computed results, footnotes are added to the daily discharge tables, stating the probable accuracy of the rating tables used, and an accuracy column is inserted in the monthly discharge table. For the rating tables "well defined" indicates, in general, that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined" or "approximate" within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The accuracy column in the monthly discharge table does not apply to the maximum or minimum nor to any individual day, but to the monthly mean. It is based on the accuracy of the rating, the probable reliability of the observer, and knowledge of local conditions. In this column A indicates that the mean monthly flow is probably accurate within 5 per cent; B, within 10 per cent; C, within 15 per cent; D, within 25 per cent. Special conditions are covered by footnotes.

Even though the monthly means for any station may represent with a high degree of accuracy the quantity of water flowing past the gage, the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors which result from including in the measured drainage area large noncontributing districts or omitting estimates of water diverted for irrigation or other use, and they should therefore be considered as only approximate, particularly for periods of irrigation or of low water. For these errors it is as a rule not feasible to make adequate correction.

In general the base data collected each year by the Survey engineers are published not only to comply with the law but to afford

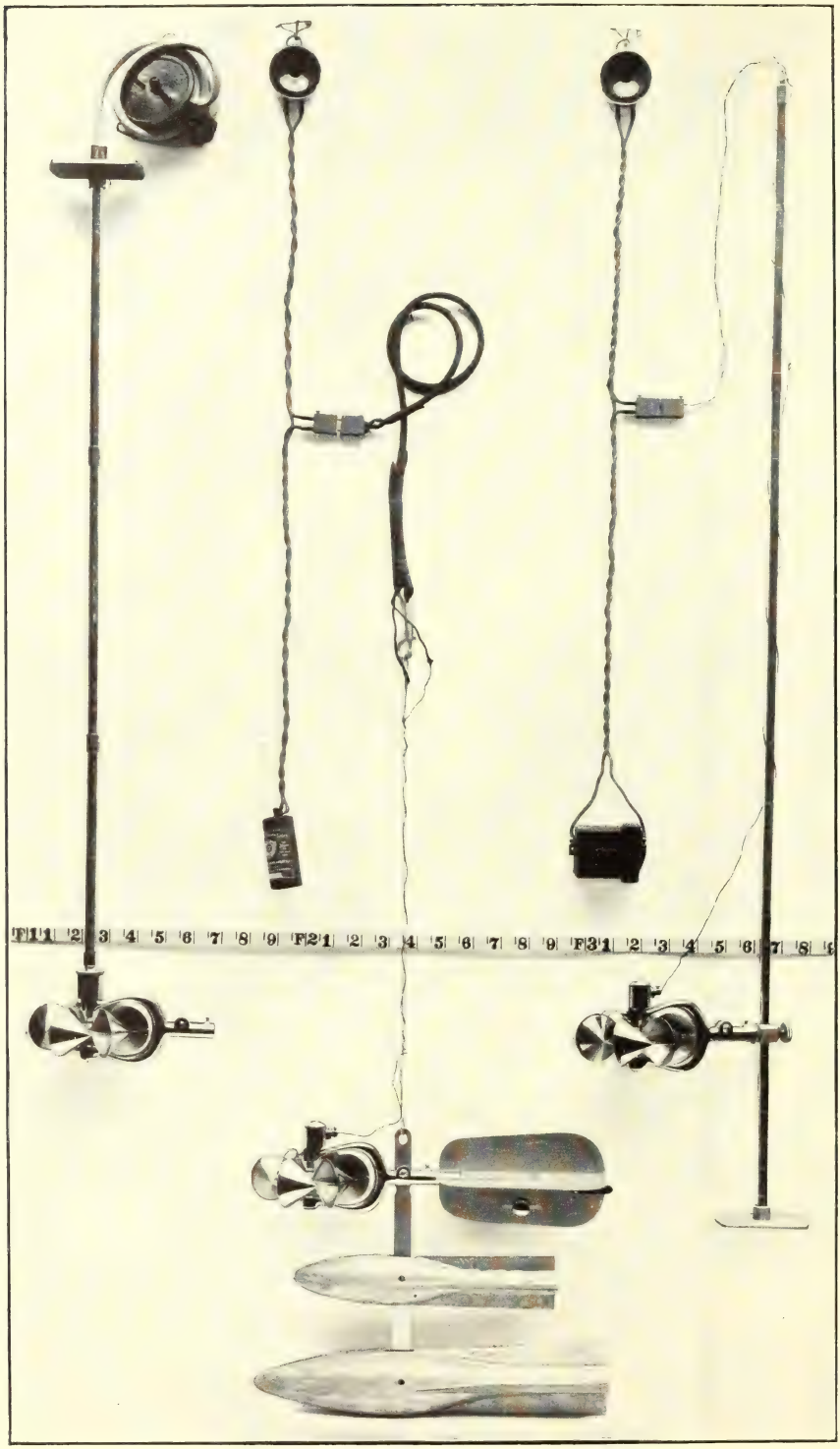
[1] See Hoyt, J. C., and others, Use and care of current meter as practiced by the United States Geological Survey: Trans. Am. Soc. Civil Eng., vol. 66, 1910, p. 70.



A. CABLE STATION WITH AUTOMATIC GAGE.

B. FOR BRIDGE MEASUREMENT.

TYPICAL GAGING STATIONS.



SMALL PRICE CURRENT METERS.

any engineer the means of examining and adjusting to his own needs the results of the computations. The table of monthly discharge is so arranged as to give only a general idea of the flow at the station and should not be used for other than preliminary estimates. The determinations of daily discharge allow more detailed studies of the variation in flow by which the period of deficiency may be determined.

It should be borne in mind that the observations in each succeeding year may be expected to throw new light on data already collected and published, and the engineer who makes use of the figures presented in these papers should verify all ratings and make such adjustments for earlier years as may seem necessary.

COOPERATION AND ASSISTANCE.

MONTANA.

Much of the work in Montana has been carried on under cooperative agreement with the United States Reclamation Service, the work being done by the Geological Survey and the expense borne by the Reclamation Service.

The State of Montana also cooperated in the work, authority having been granted by the State legislature in 1911, which passed a bill appropriating $3,000 for 1911 and $3,000 for 1912, to be expended on the work of gaging streams, in accordance with paragraph 3, section 2244, of the Revised Codes of 1907 of the State of Montana, which reads as follows:

> The State engineer shall become conversant with the waterways of the State and the needs of the State as to irrigation matters; shall make, or cause to be made, measurements and calculations of the ordinary and flood discharge of streams, cooperating in this work as much as possible with the United States Geological Survey and the Montana Experiment Station; such measurements to be made on streams in order of their importance, provided that measurements already made, if deemed reliable, may be adopted.

Much of this fund has been expended on work in connection with Carey projects.

A number of stations in the western part of Montana were maintained in cooperation with the Forest Service.

Acknowledgments are due to the several Carey Land Act companies for salaries of gage observers paid during the year; to the United Missouri River Power Co., for records on Missouri River; to the Glass-Lindsay Land Co., for gage observers' salaries at several stations; and to George E. Baker, for gage heights and discharge measurements on Pipestone and Whitehall creeks.

COLORADO.

The work in Colorado was carried on in cooperation as follows:

The United States Forest Service furnished the services of a hydrographer for measuring the streams on the national forests and also furnished the gage heights.

Mr. C. W. Comstock, State engineer, cooperated in maintaining a number of stations in the South Platte basin and furnished the completed records for a number of other stations.

Mr. George B. McFadden, of Denver, furnished the field data for two stations on the Cache la Poudre.

WYOMING.

The work in Wyoming was carried on in cooperation as follows:

Mr. A. J. Parshall, State engineer, paid half the field expense of maintaining most of the Wyoming stations and also paid the gage observers. He also arranged for cooperation with a number of individuals interested in the different records.

The United States Forest Service furnished the services of a hydrographer during the latter part of the year for measuring the streams on the national forests and also furnished the gage heights.

The United States Reclamation Service furnished the completed records on the North Platte at Pathfinder and Whalen and gage heights and gate openings on the Shoshone at Corbett dam.

NEBRASKA.

The work in Nebraska was carried on in cooperation with Mr. D. D. Price, State engineer, who furnished all the field data.

Acknowledgments are also due to the United States Weather Bureau and all other companies and persons who have rendered assistance and furnished records.

DIVISION OF WORK.

The work in the upper Missouri River basin was under the direction of W. A. Lamb, district engineer, assisted by Raymond Richards, assistant engineer, John C. Beebe and Benjamin E. Jones, junior engineers, and C. S. Heidel, State hydrographer.

The work in North Dakota was carried on by E. F. Chandler, assistant engineer, assisted by Gorie Monley and George Ebner.

The field data for the Missouri River drainage area in Colorado and the North Platte and upper Bighorn basins in Wyoming were collected under the direction of W. B. Freeman, district engineer, assisted by G. A. Gray, E. O. Christiansen, G. H. Russell, and R. H. Fletcher, junior engineers, and O. M. Wimmer and H. B. Waha, Forest Service hydrographers.

The field data in Nebraska were collected under the direction of D. D. Price, State engineer, assisted by A. A. Dobson and A. B. Price.

The rating curves and special estimates were made and the completed data prepared for publication by Raymond Richards. Computations have been made by H. J. Dean, A. H. Tuttle, and M. I. Walters. The report has been edited by Mrs. B. D. Wood.

APPROPRIATION OF WATER.

VARIATIONS IN STATE WATER LAWS.

The water laws of the Western States differ so widely in their provisions that such terms as "water filing," "appropriation," and "water right" have no general application or meaning. The rights to water in these States rest in general, first, on the Constitution and statutes of the United States; second, on the respective State constitutions and the State statutes that have been enacted in accordance therewith; third, on the decisions of Federal and State courts in the interpretation of these various provisions of law and in their application to specific conditions; and, fourth, on the requirements of the State engineers and other officials charged with the administration of the State water laws.

In addition, the right to convey water across public lands must be acquired in accordance with the provisions of the acts of Congress and the regulations of the Secretary of the Interior and the Secretary of Agriculture pursuant thereto.

In this report each description of a gaging station in Colorado gives the number of second-feet of adjudicated diversions from the stream and its tributaries, to indicate as nearly as possible the extent to which appropriations have been recognized by the State courts. It does not follow, however, that this amount of water is actually diverted, as many of the older decrees called for amounts greatly in excess of those actually used; on the other hand, no account has been taken of filings which have not yet been perfected and adjudicated. It is impossible from the State records to reach any conclusion as to the validity of these filings or as to the probability of their final perfection.

CONSTITUTIONAL PROVISIONS.

COLORADO.

In common with most of the other Western States, Colorado has discarded the common-law doctrine of riparian rights and has established a system based upon prior appropriation. The following are extracts from the State constitution relative to the use of water for irrigation:

ARTICLE XVI.

IRRIGATION.

SEC. 5. The water of every natural stream not heretofore appropriated within the State of Colorado is hereby declared to be the property of the public; and the same is dedicated to the use of the people of the State, subject to appropriation as hereinafter provided.

SEC. 6. The right to divert the unappropriated waters of any natural stream to beneficial uses shall never be denied. Priority of appropriation shall give the better right as between those using the water for the same purpose; but when the waters of any natural stream are not sufficient for the service of all those desiring the use of the

same, those using the water for domestic purposes shall have the preference over those claiming for any other purpose, and those using the water for agricultural purposes shall have preference over those using the same for manufacturing purposes.

SEC. 7. All persons and corporations shall have the right of way across public, private, and corporate lands for the construction of ditches, canals, and flumes for the purpose of conveying water for domestic purposes, for the irrigation of agricultural lands, and for mining and manufacturing purposes, and for drainage, upon payment of just compensation.

SEC. 8. The general assembly shall provide by law that the board of county commissioners, in their respective counties, shall have power, when application is made to them by either party interested, to establish reasonable maximum rates to be charged for the use of water, whether furnished by individuals or corporations.

WYOMING.

In Wyoming, as in Colorado, the courts reject riparian rights and the principal of prior appropriation is established in the State. The provisions of the State constitution regarding the appropriation and use of water are as follows:

ARTICLE I.

SEC. 31. Water being essential to industrial prosperity, of limited amount, and easy of diversion from its natural channels, its control must be in the State, which, in providing for its use, shall equally guard all the varied interests involved.

ARTICLE VIII.

IRRIGATION AND WATER RIGHTS.

SEC. 1. The water of all natural streams, springs, lakes, or other collection of still water within the boundaries of the State, are hereby declared to be the property of the State.

SEC. 2. There shall be constituted a board of control, to be composed of the State engineer and superintendents of the water divisions, which shall under such regulations as may be prescribed by law, have the supervision of the waters of the State and of their appropriation, distribution, and diversion and of the various officers connected therewith. Its decisions to be subject to review by the courts of the State.

SEC. 3. Priority of appropriation for beneficial uses shall give the better right. No appropriation shall be denied except when such denial is demanded by the public interests.

SEC. 4. The legislature shall by law divide the State into four (4) water divisions and provide for the appointment of superintendents thereof.

SEC. 5. There shall be a State engineer who shall be appointed by the governor of the State and confirmed by the senate; he shall hold his office for the term of six (6) years or until his successor shall have been appointed and shall have qualified. He shall be president of the board of control and shall have general supervision of the waters of the State and of the officers connected with its distribution. No person shall be appointed to this position who has not such theoretical knowledge and such practical experience and skill as shall fit him for the position.

ARTICLE XIII.

SEC. 5. Municipal corporations shall have the same right as individuals to acquire rights by prior appropriation and otherwise to the use of water for domestic and municipal purposes, and the legislature shall provide by law for the exercise upon the part of incorporated cities, towns, and villages of the right of eminent domain for the purpose of acquiring from prior appropriators upon the payment of just compensation, such water as may be necessary for the well being thereof and for domestic uses.

MONTANA.

The following provision in the Montana State constitution relates to the use of the water in the State:

[Art. 2, sec. 15.] The use of all water now appropriated, or that may hereafter be appropriated for sale, rental, distribution, or other beneficial use, and the right of way over the lands of others for all ditches, drains, flumes, canals, and aqueducts, necessarily used in connection therewith, as well as the sites for reservoirs necessary for collecting and storing the same, shall be held to be a public use.

NORTH DAKOTA.

The sole provision of the State constitution of North Dakota relative to the use of water is the following:

[Art. 17, sec. 210.] All flowing streams and natural water courses shall forever remain the property of the State for mining, irrigating, and manufacturing purposes.

SOUTH DAKOTA.

This State has no constitutional provisions relative to the use of water.

NEBRASKA.

The State constitution of Nebraska makes no provision for the use of water in the State.

ADMINISTRATION OF WATER LAWS.

COLORADO.

Appropriation of water in Colorado may be divided into two general classes: The direct appropriation, where the water is used as delivered from the head gates of the canal, and the appropriation for storage, where water from the river is not used at the time of diversion but is stored in reservoirs for future use. Appropriations of the second class are usually valid only during periods of high water when there is an excess of water over the needs of the direct appropriators. In the construction of reservoirs it is necessary to obtain approval of plans by the proper county commissioners, in addition to obtaining that of the State engineer, for all dams exceeding 10 feet in height. The entire construction of the reservoir is under the supervision of the State engineer, who has authority to require material used and work of construction to be done to his satisfaction. In case of failure of a reservoir the owners are liable for all ensuing damages.

The control of water by the State is vested in the State engineer, whose duty it is to supervise the diversion of water by the various appropriators in accordance with the decrees of the State courts. The State is divided into five irrigation divisions, each in charge of a division engineer, who is under the direction of the State engineer. Each irrigation division is divided into a number of water districts, of which there are 70 for the entire State. For each water district

there is appointed a water commissioner, whose duty it is, under the supervision of the division engineer, to divide the water in the natural streams among the several ditches taking water from the same, according to the rights of each. Whenever there is a scarcity of water he is empowered to shut down the head gates of those ditches whose priorities are of too recent date to entitle them to divert water. In the discharge of this duty he has the power of a constable.

WYOMING.

The constitution of the State of Wyoming creates the office of State engineer and divides the State into four principal water divisions, each under the control of a division superintendent. The State engineer and the division superintendents form a board of control having supervision of the appropriation and distribution of the water, subject to court review.

Rights to the use of water are begun by filing an application in the office of the State engineer. This application must be prepared in accordance with the State law and the requirements of the State engineer. When the application is in proper form a permit to divert the water and construct the works is issued.

The distribution of the water in accordance with the respective rights of permittees is supervised by water commissioners, one having jurisdiction in each of a large number of water districts, into which the four principal divisions are divided. The acts of the commissioners of any district are subject to review by the higher administrative officials, and eventually by the courts.

MONTANA.

An appropriation of water in Montana is begun by the posting of a notice at the proposed point of diversion, a copy of which notice is filed with the county clerk and recorder of the county in which the water is to be diverted. There is no limitation as to the amount of water upon which any person may file, and many streams have single filings upon them for more than their entire flow. Eventually, however, each appropriator can acquire the right to use only such water as he has put to beneficial use. Questions arising as to the rights of appropriators are determined by court proceedings. The State engineer has no functions relative to the diversion or distribution of water, but the State courts may appoint commissioners to enforce decrees.

Under this system examination of a stream and a search of the decrees are required to determine the title to its waters.

NORTH DAKOTA.

General supervision of matters relating to the use of water is vested in the State engineer, who is particularly charged with the custody

of records and the survey of streams. The State is divided into four water divisions, each in charge of a commissioner, and each division may be further subdivided into districts, each having a water master. The water commissioners, together with the State engineer, constitute a board empowered to make general rules for the control of water.

Appropriations made prior to the present water law are adjudicated by the courts, one copy of the decree being filed in the office of the State engineer. Applications to appropriate water are filed with the State engineer, the procedure therefor being similar to that in Wyoming.

NEBRASKA.

Control of water for irrigation is vested in the State board of irrigation, highways, and drainage, which consists of the governor, attorney general, and commissioner of public lands. The State engineer is appointed by the board, and acts as its secretary. The State is divided into two water divisions, each in charge of a superintendent. Within these divisions water districts, in charge of water commissioners, may be created as needed. The water commissioners control the distribution of water to the respective appropriators.

Applications to appropriate water for irrigation are made to the State board in accordance with the regulations. Upon approval the applicant may construct the necessary works. A certificate is finally issued by the State board and recorded with the county clerk.

Storage reservoirs are subject to special provisions of law, and dams over 10 feet high must be authorized by the board.

IRRIGATION DISTRICTS.

With the growth of irrigation in Colorado it has become necessary to enact laws creating irrigation districts whereby the owners of adjacent lands may organize for the purpose of jointly conveying water to irrigate these lands. When a majority of landowners in a district desire to irrigate their lands, they may petition the county commissioners of the county in which the greatest acreage of land is located to organize an irrigation district. An election is then held by the commissioners at which all the landowners in the proposed district are entitled to vote on the question of organization. If the result of the election favors it, the irrigation district is organized and a board of three directors elected. This board is empowered to enter into contracts for completing the necessary structures to irrigate the lands, and to acquire rights of way, water rights, etc. Similar statutes have been enacted in Wyoming, Montana, and Nebraska.

THE CAREY ACT.

The act of August 18, 1894 (28 Stat., 372, 422), commonly known as the Carey Act, and amendments thereto, the purpose of which is to aid the public-land States in the reclamation of the desert lands

therein and in the settlement, cultivation, and sale of such lands in small tracts to actual settlers, authorize—

(*a*) The temporary withdrawal of public lands from settlement or entry pending investigation and survey preliminary to the filing of an application for segregation, such withdrawn lands to be restored to settlement and entry at the end of one year from the date of withdrawal in case application for segregation is not theretofore made.

(*b*) The segregation of public lands by the Secretary of the Interior, contracts between the United States and any beneficiary State, and the reclamation of such lands by beneficiary States within 10 years from the approval of the State's application (subject to an extension of five years).

(*c*) The patenting to any beneficiary State of any tract of reclaimed land when satisfactory proof is made that an ample supply of water to reclaim it is actually furnished.

The usual procedure under the Carey Act is about as follows:

A corporation or individual applies to the State for the withdrawal of certain public lands proposed for irrigation. The State thereupon submits to the Interior Department an application for their withdrawal. On the approval of this application the State is allowed one year in which to investigate the project and prepare satisfactory plans for reclamation. The proposing company conducts the investigation and, if a project that is considered feasible is developed, makes application to the State for the segregation of the irrigable lands and offers to contract with the State for their reclamation. The State thereupon applies to the Interior Department for the segregation of the lands under the terms of the Carey Act and its amendments. If the plan of irrigation is found to be feasible, the irrigation company responsible, and the available water supply adequate, the lands are segregated and the contract for their reclamation is entered into between the United States and the State. When the irrigation works are completed to the satisfaction of the Government, patent is issued to the State or to its assigns. The State receives payment for the lands from the settler, and the irrigation company, either directly or through the State, receives payment from each settler for his proportionate share of the irrigation works and water rights involved.

The Tenth General Assembly of Colorado, by an act approved March 15, 1895, accepted the conditions and grants of land to the State under the provisions of the Carey Act. The subsequent State laws stipulate that the selection, management, and disposal of such lands shall be vested in the State board of land commissioners. Before a project is approved the engineering features must be passed upon by the State engineer. Similar statutes have been enacted by Wyoming and Montana.

GAGING STATION RECORDS.

MISSOURI RIVER PROPER.

RED ROCK RIVER ABOVE RED ROCK RESERVOIR, NEAR MONIDA, MONT.

Location.—At wagon bridge on Lyon's ranch, 18 miles east of Monida, and about 12 miles above the dam of the Red Rock Reservoir & Irrigation Co.

Records available.—Four miscellaneous measurements in 1910; May to October, 1911.

Drainage area.—Not measured.

Gage.—Staff gage nailed to piling on downstream side of bridge.

Channel.—Very liable to change. The stream is very sluggish, sediment is apt to accumulate, and weeds grow on the bed.

Discharge measurements.—Made from the downstream side of bridge at high water; by wading above the bridge at low water.

Winter flow.—May be affected by ice from November till the ice breaks up in the spring.

Artificial control.—Little or none above the station.

Accuracy.—Fair. The shifting channel affects the results.

Discharge measurements of Red Rock River above Red Rock reservoir, near Monida, Mont., in 1910–11.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
1910.		*Feet.*	*Sec.-ft.*	1911.		*Feet.*	*Sec.-ft.*
July 6	Lamb and Wade	2.50	38	Apr. 24	C. S. Heidel	4.78	445
19	C. S. Heidel	2.52	38	July 11	do	3.31	139
30	do	2.42	34	Sept. 20	do	3.10	89

Daily gage height, in feet, of Red Rock River above Red Rock reservoir, near Monida, Mont., for 1911.

[Mark Lyons, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		4.4	4.2	3.0	2.9	3.45	3.5
2		4.8	4.0	3.05	2.85	3.4	3.5
3		4.9	3.5	3.1	3.0	3.4	
4		4.9	3.6	3.1	3.05	3.4	3.5
5		4.9	3.6	3.2	3.05		
6		4.8	3.5	3.2	3.1	3.4	
7	5.5	4.8	3.5	3.1		3.45	
8	5.4	4.7	3.4	3.0		3.45	
9	5.3	4.8	3.3	3.1		3.4	
10	5.2	4.7	3.3	3.0			
11	5.0	4.8	3.3	3.0		3.3	
12	5.2	4.8	3.3	3.0	3.2		
13	5.2	4.8	3.3	3.1	3.2		
14	5.1	4.7	3.25	3.0	3.1	3.5	
15	5.0	4.7	3.2	3.0	3.1	3.5	
16	4.9	4.6	3.2	3.0	3.1	3.45	
17	4.8	4.6	3.2	3.1	3.1	3.4	
18	4.5	4.45	3.2	3.0	3.1	3.4	
19	4.3	4.35	3.1	2.9	3.1	3.4	
20	4.3	4.3	3.05	2.9	3.1	3.4	
21	4.3	4.25	3.0	2.85	3.1	3.4	
22	4.3	4.2	3.0	2.85	3.1	3.4	
23	4.45	4.1	3.0	2.8	3.1	3.4	
24	4.6	4.0	3.0	2.8	3.1		
25	4.6	3.9	3.05	2.85	3.2	3.5	
26	4.9	3.7	3.2	2.8	3.2		
27	4.8	3.65	3.1	2.85	3.2	3.5	
28	4.5	3.8	3.1	2.9	3.1	3.7	
29	4.5	3.8	3.0	2.9	3.1	3.7	
30	4.4	4.1	3.0	2.85	3.1		
31	4.3		3.0	2.85			

NOTE.—Ice present after Oct. 23.

Daily discharge, in second-feet, of Red Rock River above Red Rock reservoir, near Monida, Mont., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	500	345	295	85	75	148
2	500	445	255	90	70	140
3	550	470	155	95	85	140
4	550	470	175	95	90	140
5	600	470	175	110	90	140
6	600	445	155	110	95	140
7	650	445	155	95	98	148
8	620	420	140	85	100	148
9	590	445	125	95	102	140
10	560	420	125	85	105	132
11	500	445	125	85	108	125
12	560	445	125	85	110	135
13	560	445	125	95	110	145
14	530	420	118	85	95	155
15	500	420	110	85	95	155
16	470	395	110	85	95	148
17	445	395	110	95	95	140
18	370	358	110	85	95	140
19	320	332	95	75	95	140
20	320	320	90	75	95	140
21	320	308	85	70	95	140
22	320	295	85	70	95	140
23	358	275	85	65	95	140
24	395	255	85	65	95	130
25	395	235	90	70	110	130
26	470	195	110	65	110	130
27	445	185	95	70	110	130
28	370	215	95	75	95	130
29	370	215	85	75	95	130
30	345	275	85	70	95	130
31	320	.....	85	70	.....	130

NOTE.—Daily discharge determined from a fairly well-defined discharge rating curve. Discharge interpolated for days for which gage heights are missing.

Monthly discharge of Red Rock River above Red Rock reservoir, near Monida, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	650	320	465	28,600	B.
June	470	185	360	21,400	B.
July	295	85	124	7,620	B.
August	110	65	82.6	5,080	B.
September	110	70	96.6	5,750	B.
October	155	125	139	8,550	B.
The period	.....	.....	.....	77,000	

RED ROCK RIVER BELOW RED ROCK RESERVOIR, NEAR MONIDA, MONT.

Location.—Just below the reservoir of the Red Rock Reservoir & Irrigation Co., 8 miles northeast of Monida and 15 miles east of Lima.

Records available.—July 22, 1911, to November 30, 1911. Miscellaneous measurements were made at this point on Red Rock River during the summer of 1910.

Drainage area.—About 560 square miles.

Gages.—A temporary staff gage about 300 yards downstream from the dam and a float gage in a concrete well on the right bank, at a 40-foot weir, about halfway between the dam and the staff gage. The 1911 records are referred to the staff gage.

Channel.—Probably permanent; bed of stream composed of coarse gravel, pebbles, and bowlders; current strong.

Discharge measurements.—Made by wading.

Winter flow.—Affected by ice.

Regulation.—The dam is used to store flood waters which are released during the latter part of the irrigation season.

Accuracy.—Both staff gage and weir readings should be reliable.

Discharge measurements of Red Rock River below Red Rock reservoir, near Monida, Mont., 1910-11.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
1910.		*Feet.*	*Sec.-ft.*	1911.		*Feet.*	*Sec.-ft.*
July 7 [a]	Lamb and Wade	2.20	36	July 11	C. S. Heidel	3.10	188
7 [a]	do	2.10	29	12	do	[b] 3.03	152
7 [a]	do	2.49	65	Sept. 20	do	[c] 2.74	102
7 [a]	do	2.85	127				
7 [a]	do	1.80	13.1				
19	C. S. Heidel	2.43	65				
30	do	2.35	58				

[a] Measurement made 1,000 feet below dam. [b] Weir gage read 1.04 feet. [c] Weir gage read .81 feet.

Daily gage height, in feet, and discharge, in second-feet, of Red Rock River below Red Rock reservoir, near Monida, Mont., for 1911.

[P. V. Maxwell, observer.]

Day.	July.		Aug.		Sept.		Oct.		Nov.	
	Gage height.	Discharge.	Gage height.	Dis. charge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			2.62	86	2.50	69	2.72	101	2.90	135
2			2.61	84	2.50	69	2.72	101	3.05	165
3			2.60	83	2.50	69	2.71	100	3.15	188
4			2.60	83	2.50	69	2.71	100	3.25	212
5			2.66	92	2.60	83	2.71	100	3.30	225
6			2.68	95	2.60	83	2.71	100	3.35	238
7			2.68	95	2.67	94	2.71	100	3.35	238
8			2.71	100	2.74	105	2.71	100	3.40	250
9			2.74	105	2.74	105	2.71	100	3.50	280
10			2.74	105	2.74	105	2.71	100	3.50	280
11			2.73	103	2.74	105	2.72	101	3.50	280
12			2.68	95	2.72	101	2.71	100	3.50	280
13			2.62	86	2.72	101	2.71	100	3.50	280
14			2.54	75	2.72	101	2.71	100	3.50	280
15			2.46	64	2.72	101		140	3.15	188
16			2.46	64	2.72	101		180	2.84	123
17			2.45	63	2.72	101		220	2.84	123
18			2.45	63	2.72	101		260	2.84	123
19			2.46	64	2.72	101		300	2.84	123
20			2.47	65	2.72	101		340	2.84	123
21			2.50	69	2.72	101		380	2.84	123
22			2.50	69	2.72	101	3.90	415	2.84	123
23	2.68	95	2.50	69	2.72	101	3.95	432	2.84	123
24	2.67	94	2.50	69	2.72	101	4.00	450	2.84	123
25	2.67	94	2.50	69	2.72	101	3.95	432	2.84	123
26	2.67	94	2.50	69	2.72	101	3.90	415	2.84	123
27	2.63	88	2.50	69	2.72	101	3.90	415	2.84	123
28	2.63	88	2.50	69	2.72	101	3.40	250	2.84	123
29	2.63	88	2.50	69	2.72	101	2.89	133	2.84	123
30	2.63	88	2.50	69	2.72	101	2.84	123	2.84	123
31	2.63	88	2.50	69			2.80	115		

NOTE.—Gage heights refer to staff gage. Discharge determined from a very well-defined rating curve. Discharge interpolated Oct. 15 to 21.

Monthly discharge of Red Rock River below Red Rock reservoir, near Monida, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
July 23-31	95	88	90.8	1,620	A.
August	105	63	78.4	4,820	A.
September	105	69	95.8	5,700	A.
October	450	100	207	12,700	A.
November	280	123	179	10,700	A.

RED ROCK RIVER AT LIMA, MONT.

Location.—Near the Gleed ranch, 1 mile east of Lima, Mont. Principal tributaries below the station, Sheep and Sage creeks.

Records available.—August 14, 1907, to September 30, 1911.

Drainage area.—Not measured.

Gage.—Chain; installed October 27, 1908, at a point just above the cable and 300 feet farther downstream than the old staff gage which it replaced; datum of chain gage not the same as that of the staff gage.

Channel.—Probably permanent.

Discharge measurements.—At ordinary and high-water stages made from a cable below the gage; at extremely low stages measurements made by wading just below the cable section.

Winter flow.—River generally remains open the entire year, as a large spring discharges into the stream just above the gage.

Diversions.—Three ditches, each carrying approximately 900 miner's inches, take water from Red Rock above the station. The flow of water above the station is all appropriated, but the rights are unadjudicated.

Storage.—The dam ot the reservoir storing the water of the Red Rock has been completed, but no canals have been built. The dam is of earth with concrete core, is 50 feet high, and will impound 90,000 acre-feet; its top elevation is 6,700 feet; the dam is 16 miles above Lima, Mont., and 27 miles below lower Red Rock Lake.

Accuracy.—In general, the results obtained at this station should be good.

Discharge measurements of Red Rock River at Lima, Mont., 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 25	C. S. Heidel	0.55	18
July 13	do	1.88	191
Sept. 22	do	1.52	122

Daily gage height, in feet, of Red Rock River at Lima, Mont., for 1911.

[Alice Gleed, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.55	1.00	0.50	0.55	2.15	3.05	2.10	1.15	1.30
2	.55	1.60	.50	.55	2.25	2.80	2.10	1.15	1.35
3	.50	1.10	.50	.55	2.25	2.80	2.10	1.15	1.30
4	.50	1.60	.50	.55	2.25	2.80	2.00	1.15	1.35
5	.45	1.05	.45	.50	2.30	2.80	1.90	1.15	1.25
6	.50	1.10	.50	.55	2.30	2.75	1.90	1.15	1.35
7	.50	1.20	.50	.55	2.60	2.80	1.95	1.15	1.30
8	.50	.70	.55	1.05	2.95	2.80	1.95	1.15	1.35
9	.55	.60	.50	1.10	2.85	2.85	2.00	1.20	1.30
10	.50	.55	.45	.75	2.85	2.85	2.05	1.20	1.40
11	.50	.60	.50	.65	2.85	2.85	2.00	1.20	1.40
12	.50	.60	.50	.65	2.90	2.75	2.05	1.20	1.45
13	.50	.60	.50	.65	2.90	2.65	2.05	1.20	1.45
14	.50	.60	.50	.65	2.90	2.65	2.00	1.20	1.55
15	.45	.50	.45	.60	2.95	2.70	2.05	1.10	1.60
16	.55	.55	.50	.60	2.95	2.70	2.05	1.10	1.65
17	.55	.55	.55	.60	2.95	2.70	1.40	1.05	1.70
18	.50	.55	.55	.60	2.95	2.75	1.40	1.05	1.75
19	.50	.55	.55	.65	2.95	2.80	1.30	1.05	1.70
20	.45	.50	.50	.55	2.95	2.80	1.30	1.05	1.70
21	.50	.55	.55	.60	2.90	2.85	1.30	1.05	1.70
22	.50	.55	.55	.70	2.95	2.90	1.30	1.05	1.75
23	.50	.55	.55	.65	2.95	2.85	1.15	1.05	1.50
24	.50	.55	.55	.60	2.90	2.85	1.20	1.05	1.55
25	.45	.50	.50	.50	2.95	2.85	1.20	1 05	1 40
26	.50	.50	.55	1.30	2.85	2.00	1.20	1.05	1.50
27	50	.50	.55	1.40	2.85	2.00	1.05	1.25	1.30
28	.50	.50	.55	1.50	2.95	2.05	1.20	1.35	1.35
29	.50	.....	.55	1.60	3.05	2.05	1.20	1.30	1.30
30	.45	.....	.50	1.90	3.1	2.15	1.20	1.30	1.30
31	.50	.....	.55	.....	3.05	.....	1.15	1.30	.....

NOTE.—Ice present Feb. 1 to 8.

Daily discharge, in second-feet, of Red Rock River at Lima, Mont., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	18	17	16	18	250	510	237	66	85
2	18	17	16	18	276	432	237	66	92
3	16	18	16	18	276	432	237	66	85
4	16	18	16	18	276	432	213	66	92
5	14	19	14	16	289	432	191	66	78
6	16	19	16	18	289	417	191	66	92
7	16	20	16	18	372	432	202	66	85
8	16	20	18	54	478	432	202	66	92
9	18	21	16	60	448	448	213	72	85
10	16	18	14	30	448	448	225	72	99
11	16	21	16	24	448	448	213	72	99
12	16	21	16	24	463	417	225	72	106
13	16	21	16	24	463	387	225	72	106
14	16	21	16	24	463	387	213	72	122
15	14	16	14	21	478	402	225	60	131
16	18	18	16	21	478	402	225	60	140
17	18	18	18	21	478	402	99	54	150
18	16	18	18	21	478	417	99	54	160
19	16	18	18	24	478	432	85	54	150
20	14	16	16	18	478	432	85	54	150
21	16	18	18	21	463	448	85	54	150
22	16	18	18	26	478	463	85	54	160
23	16	18	18	24	478	448	66	54	114
24	16	18	18	21	463	448	72	54	122
25	14	16	16	16	478	448	72	54	99
26	16	16	18	85	448	213	72	54	114
27	16	16	18	99	448	213	54	78	85
28	16	16	18	114	478	225	72	92	92
29	16	.....	18	131	510	225	72	85	85
30	14	.....	16	191	525	250	72	85	85
31	16	.....	18	.....	510	.....	66	85	.....

Monthly discharge of Red Rock River at Lima, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	18	14	16	984	B.
February	21	16	18.2	1,010	B.
March	18	14	16.6	1,020	B.
April	191	16	40.6	2,420	B.
May	525	250	432	26,600	B.
June	510	213	397	23,600	B.
July	237	54	149	9,160	B.
August	92	54	66	4,060	B.
September	160	78	110	6,550	B.
The period				75,400	

BEAVERHEAD RIVER AT BARRATTS, MONT.

Location.—One mile above Barratts and 2 miles southwest of Dillon, Mont., in the SW. ¼ SW. ¼ sec. 20, T. 8 S., R. 9 W.

Records available.—August 12, 1907, to December 31, 1911.

Drainage area.—Not measured.

Gage.—A standard chain gage was installed on the downstream side of the bridge June 22, 1908, to replace the ordinary staff gage which had previously been used; datum of chain gage the same as that of the staff gage.

Channel.—Should not shift; rocky at the measuring section.

Discharge measurements.—Made from downstream side of the bridge.

Winter flow.—Stream remains open during the winter months.

Diversions.—Innumerable diversions are made above the station. Decreed water rights, aggregating 85,866 inches of water, are filed on from Lima on Red Rock River to a point 10 miles above Twin Bridges. The three largest canals diverted below the station are Canyon Creek canal, appropriating 6,000 inches; Union canal, appropriating 4,000 inches; and Beaverhead canal, diverted just north of Dillon, appropriating 5,000 inches. The Union Electric Co., of Dillon, has a canal with a carrying capacity of 6,000 inches.

Beaverhead River is called Red Rock River from its source in Red Rock Lakes to the post office of Red Rock, below which it is called the Beaverhead. The principal tributaries to the Beaverhead above the station are Grasshopper Creek, 12 miles south of Dillon; Horse Prairie Creek, 20 miles south; and Rattlesnake and Blacktail Deer creeks. Irrigation has probably been practiced in Beaverhead Valley longer than in any other valley in Montana, ditches constructed in the early seventies being still in operation.

Discharge measurements of Beaverhead River at Barratts, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 22	C. S. Heidel	1.26	416
July 10	do	1.02	291
Sept. 19	do	.78	214

Daily gage height, in feet, of Beaverhead River at Barratts for 1911.

[W. A. Meeds, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.60	1.20	1.50	1.90	0.78	0.69	0.85	1.60
2	.....	1.55	1.20	1.90	1.90	.81	.67	.92	1.50
3	.....	1.45	1.20	2.00	1.60	.94	.70	.91	1.50
4	.....	1.30	1.20	1.90	1.40	1.10	.80	.84	1.50
5	.....	1.20	1.15	1.95	1.25	1.05	.81	.88	1.60
6	.....	1.05	1.15	2.00	1.20	1.05	.90	.90	1.70
7	.....	1.05	1.20	1.90	1.10	.98	.86	.91	1.70
8	.....	1.00	1.25	2.20	1.05	.88	.90	.90	1.70
9	.....	1.05	1.25	2.20	1.05	.87	.85	.98	1.60
10	.....	1.20	1.10	2.20	1.05	.87	.85	1.05	1.70
11	.....	1.10	1.10	1.85	.97	.86	.75	1.25	1.70
12	0.86	1.05	1.00	1.95	.87	.86	.80	1.25	1.60
13	.88	.88	1.00	1.90	.85	.82	.90	1.30	1.60
14	.88	.86	1.05	2.10	.79	.80	.90	1.30	1.70
15	.88	.91	1.20	2.20	.85	.80	.80	1.30	.....
16	.87	.96	1.40	2.20	.79	.76	.80	1.25	.....
17	.96	1.00	1.40	2.10	.83	.77	.80	1.25	.....
18	1.05	.96	1.30	1.95	.82	.77	.75	1.25	.....
19	1.10	1.05	1.20	1.95	.79	.78	.80	1.30	.....
20	1.15	1.10	1.20	2.50	.77	.75	.81	1.35	.....
21	1.30	1.15	1.10	2.70	.77	.76	.80	1.40	.....
22	1.30	1.20	1.15	2.40	.77	.75	.75	1.50	.....
23	1.30	1.20	1.20	1.90	.82	.74	.80	1.65	.....
24	1.45	1.20	1.45	1.65	.81	.74	.84	1.75	.....
25	1.35	1.15	1.60	1.55	.78	.71	.81	1.85	.....
26	1.15	1.20	1.80	1.35	.79	.71	.80	1.90	.....
27	1.10	1.30	1.85	1.30	.79	.71	.80	1.90	.....
28	1.05	1.45	1.80	1.40	.79	.67	.84	1.75	.....
29	1.10	1.40	1.65	1.45	.79	.66	.85	1.60	.....
30	1.30	1.30	1.50	1.75	.81	.66	.85	1.50	.....
31	1.45	.....	1.45	.....	.79	.67	.....	1.50	.....

Daily discharge, in second-feet, of Beaverhead River at Barratts for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	200	595	385	540	770	213	182	238	595
2	204	568	385	770	770	224	174	263	540
3	208	512	385	835	595	271	185	259	540
4	212	435	385	770	485	340	220	234	540
5	216	385	362	802	410	318	224	248	595
6	220	318	362	835	385	318	255	255	650
7	224	318	385	770	340	287	241	259	650
8	228	295	410	965	318	248	255	275	650
9	232	318	410	965	318	245	238	287	595
10	235	385	340	965	318	245	238	318	650
11	238	340	340	740	283	241	202	410	650
12	241	318	295	802	245	241	220	410	595
13	248	248	295	770	238	227	255	435	595
14	248	241	318	900	216	220	255	435	650
15	248	259	385	965	238	220	220	435	630
16	244	279	485	965	216	206	220	410	610
17	279	295	485	900	230	210	220	410	440
18	318	279	435	802	227	210	202	410	433
19	340	318	385	802	216	213	220	435	426
20	362	340	385	1,170	210	202	224	460	419
21	435	362	340	1,310	210	206	220	485	412
22	435	385	362	1,100	210	202	202	540	405
23	435	385	385	770	227	199	220	623	398
24	512	385	512	622	224	199	234	680	391
25	460	362	595	568	213	188	224	740	384
26	362	385	710	460	216	188	220	770	377
27	340	435	740	435	216	188	220	770	370
28	318	512	710	485	216	174	234	680	363
29	340	485	622	512	216	171	238	595	356
30	435	435	540	680	224	171	238	540	350
31	512	.....	512	.....	216	174	.....	540	.....

NOTE.—Daily discharge determined from a well-defined rating curve. Discharge estimated Mar. 1 to 11 and Nov. 15 to 30.

Monthly discharge of Beaverhead River at Barratts, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 250	15,400	D.
February	.....	.....	[a] 200	11,100	D.
March	512	200	300	18,400	C.
April	595	241	373	22,200	B.
May	740	295	440	27,100	B.
June	1,310	435	799	47,500	B.
July	770	210	304	18,700	B.
August	340	171	224	13,800	B.
September	255	174	223	13,300	B.
October	770	234	447	27,500	B.
November	650	350	509	30,300	C.
December	.....	.....	[a] 350	21,500	D.
The year	1,310	.....	368	267,000	

[a] Estimated.

JEFFERSON RIVER NEAR SILVERSTAR, MONT.

Location.—In sec. 23, T. 2 S., R. 6 W., at the big highway bridge on the road from Silverstar to Iron Rod, a station on a branch of the Northern Pacific Railway. The principal tributaries below the station are Pipestone and Whitetail creeks and Boulder River.

Records available.—August 11 to December 31, 1910; May 1 to October 31, 1911.

Drainage area.—Not measured.

Gage.—Standard staff gage fastened to pier on downstream side.

Channel.—Gravel.

Discharge measurements.—Made from the lower side of highway bridge.

Winter flow.—Ice present.

Diversions.—Irrigation is carried on extensively from the headwaters of this stream to its mouth.

Discharge measurements of Jefferson River near Silverstar, Mont., 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 26	C. S. Heidel	3.53	2,590
June 14	do	6.20	8,710
July 7	do	2.94	1,510
Sept. 14	do	2.60	920

Daily gage height, in feet, of Jefferson River near Silverstar, Mont., for 1911.

[C. A. Barkell, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.60	3.75	.....	2.20	2.30	2.55	3.20
2	.....	3.50	3.90	4.0	2.10	2.30	2.60	3.20
3	.....	3.45	4.7	3.90	1.95	2.30	2.60	3.15
4	.....	3.50	5.0	3.70	2.00	2.30	2.55	3.10
5	.....	3.55	5.3	3.50	2.10	2.35	2.55	3.15
6	.....	3.60	5.8	3.45	2.30	2.51	2.50	3.15
7	.....	3.70	5.8	3.30	2.20	2.55	2.50	3.20
8	.....	3.75	5.9	3.30	2.20	2.60	2.55	3.20
9	.....	3.80	6.1	3.25	2.25	2.70	2.60	.....
10	.....	3.80	6.2	3.15	2.30	2.70	2.65	.....

Daily gage height, in feet, of Jefferson River near Silverstar, Mont., for 1911—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
11	.....	3.75	6.2	3.10	2.30	2.65	2.70	.....
12	.....	3.60	6.2	3.00	2.35	2.60	2.70	.....
13	.....	3.60	6.2	3.00	2.40	2.55	2.75	.....
14	.....	3.65	6.2	2.90	2.40	2.40	2.80	.....
15	.....	3.80	6.3	2.80	2.35	2.40	2.80	.....
16	.....	3.90	6.4	2.75	2.30	2.32	2.85	.....
17	.....	3.90	6.3	2.75	2.30	2.30	2.90	.....
18	.....	3.90	6.2	2.75	2.30	2.30	2.90	.....
19	.....	4.0	6.0	2.70	2.25	2.32	2.95	.....
20	.....	3.90	6.0	2.70	2.20	2.35	3.00	.....
21	.....	3.80	5.9	2.65	2.20	2.40	3.00	.....
22	.....	3.70	5.6	2.65	2.20	2.40	3.05	.....
23	.....	3.70	5.4	2.60	2.15	2.35	3.00	.....
24	.....	3.60	5.2	2.50	2.10	2.40	3.00	.....
25	.....	3.60	5.0	2.45	2.10	2.40	3.00	.....
26	.....	3.65	4.9	2.40	2.10	2.45	3.00	.....
27	3.60	3.70	4.6	2.40	2.15	2.50	3.00	.....
28	3.70	3.70	4.5	2.20	2.20	2.50	3.10	.....
29	3.80	3.70	4.2	2.20	2.20	2.50	3.20	.....
30	3.80	3.70	4.1	2.20	2.25	2.50	3.20	.....
31	.....	3.60	.....	2.20	2.30	.....	3.25	.....

NOTE.—Gage heights distorted by ice after Oct. 27.

Daily discharge, in second-feet, of Jefferson River near Silverstar, Mont., for 1911.

[C. A. Barkell, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2,500	2,790	3,400	620	710	955
2	.....	2,320	3,090	3,300	540	710	1,010
3	.....	2,240	4,870	3,090	440	710	1,010
4	.....	2,320	5,600	2,690	470	710	955
5	.....	2,410	6,360	2,320	540	755	955
6	.....	2,500	7,660	2,240	710	911	900
7	.....	2,690	7,660	1,980	620	955	900
8	.....	2,790	7,930	1,980	620	1,010	955
9	.....	2,890	8,470	1,900	665	1,120	1,010
10	.....	2,890	8,740	1,740	710	1,120	1,060
11	.....	2,790	8,740	1,660	710	1,060	1,120
12	.....	2,500	8,740	1,510	755	1,010	1,120
13	.....	2,500	8,740	1,510	800	955	1,180
14	.....	2,600	8,740	1,370	800	800	1,240
15	.....	2,890	9,010	1,240	755	800	1,240
16	.....	3,090	9,280	1,180	710	728	1,300
17	.....	3,090	9,010	1,180	710	710	1,370
18	.....	3,090	8,740	1,180	710	710	1,370
19	.....	3,300	8,200	1,120	665	728	1,440
20	.....	3,090	8,200	1,120	620	755	1,510
21	.....	2,890	7,930	1,060	620	800	1,510
22	.....	2,690	7,140	1,060	620	800	1,580
23	.....	2,690	6,620	1,010	580	755	1,510
24	.....	2,500	6,100	900	540	800	1,510
25	.....	2,500	5,600	850	540	800	1,510
26	.....	2,600	5,350	800	540	850	1,510
27	2,500	2,690	4,630	800	580	900	1,510
28	2,690	2,690	4,400	620	620	900	1,500
29	2,890	2,690	3,730	620	620	900	1,500
30	2,890	2,690	3,510	620	665	900	1,500
31	.....	2,500	.....	620	710	.....	1,500

Monthly discharge of Jefferson River near Silverstar, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	3,300	2,240	2,700	166,000	B.
June	9,280	2,790	6,850	408,000	B.
July	3,400	620	1,510	92,800	B.
August	800	440	639	39,300	B.
September	1,120	710	846	50,300	B.
October	1,580	900	1,270	78,100	B.
The period				835,000	

MISSOURI RIVER AT TOSTON, MONT.

Location.—In SW. ¼ sec. 23, T. 5 N., R. 2 E., at the highway bridge crossing Missouri River at Toston, Mont.; about 25 miles below the union of Gallatin, Jefferson, and Madison rivers.

Records available.—April 5, 1910, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Standard chain gage attached to downstream side of bridge.

Channel.—Rocky and permanent.

Discharge measurements.—Made from cable just above bridge.

Winter flow.—Affected by ice only in extremely cold weather.

The only important tributary between the gaging station and the headwater forks is Sixteenmile Creek.

Discharge measurements of Missouri River at Toston, Mont., 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 12	B. E. Jones	4.05	4,760
June 19	do	7.85	21,900
July 17	do	3.82	3,750
Aug. 18	do	3.48	3,220

Daily gage height, in feet, of Missouri River at Toston, Mont., for 1911.

[W. B. Lorentz, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.05	7.7	6.2	3.90	4.4	5.2	5.4	3.20	2.95	3.45	3.65	3.50
2	2.75	7.5	6.6	4.1	4.4	5.8	5.4	3.15	2.95	3.45	3.60	3.45
3	3.00	7.2	6.5	4.1	4.2	6.6	5.2	3.10	3.00	3.45	3.65	3.40
4	3.65	7.2	6.4	4.1	4.2	6.8	.....	3.15	3.10	3.55	3.70	3.50
5	3.35	7.6	6.1	4.3	4.3	7.6	5.0	3.20	3.00	3.60	3.70	3.45
6	3.25	7.4	5.2	4.3	4.4	7.7	5.0	3.35	2.95	3.55	3.85	3.50
7	3.30	7.5	4.6	4.3	4.6	7.8	4.9	3.40	3.15	3.55	3.75	3.50
8	3.35	6.6	5.0	4.2	4.8	7.8	4.8	3.40	3.40	3.55	3.65	3.45
9	3.35	5.5	4.4	4.1	4.9	8.0	4.7	3.35	3.45	3.55	3.70	3.50
10	3.25	5.4	4.0	4.0	5.0	8.0	4.6	3.25	3.45	3.60	3.15	3.45
11	3.30	5.0	4.3	4.0	4.9	8.0	4.4	3.35	3.45	3.55	3.00	3.55
12	2.90	4.1	4.0	4.05	4.8	8.0	4.1	3.40	3.45	3.55	2.85	3.45
13	5.2	4.2	3.85	4.0	4.6	8.2	3.8	3.35	3.40	3.55	3.05	3.45
14	8.8	4.2	3.90	3.95	4.6	8.2	3.85	3.60	3.45	3.65	3.80	3.50
15	9.0	4.2	3.90	3.80	4.6	8.4	3.80	3.65	3.45	3.80	3.75	3.45
16	8.9	4.0	4.0	3.80	4.8	8.4	3.70	3.60	3.45	3.70	3.70	3.45
17	8.9	3.95	4.1	3.80	5.0	8.2	3.75	3.60	3.45	3.65	3.65	3.55
18	8.8	3.85	3.95	3.85	5.1	8.0	3.55	3.55	3.50	3.65	3.85	3.50
19	9.0	4.0	3.90	3.80	5.0	7.8	3.50	3.50	3.45	3.65	4.0	3.30
20	8.7	3.80	3.95	3.90	5.0	7.6	3.50	3.15	3.45	3.75	3.90	3.25

Daily gage height, in feet, of Missouri River at Toston, Mont., for 1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	8.5	3.80	4.0	3.90	5.0	7.6	3.50	2.95	3.35	3.70	3.75	3.35
22	8.5	4.4	4.0	3.95	4.8	7.6	3.45	2.95	3.45	3.65	3.85	3.40
23	8.5	5.4	4.1	4.0	4.7	7.3	3.45	2.95	3.45	3.65	3.85	3.45
24	8.3	7.4	4.1	4.2	4.8	7.0	3.50	3.05	3.40	3.70	3.80	3.55
25	7.8	5.4	4.1	4.2	5.0	6.8	3.35	2.95	3.35	3.80	3.65	3.15
26	7.8	7.5	4.1	4.1	5.4	6.2	3.25	3.00	3.45	3.75	3.60	3.05
27	7.8	6.4	3.90	4.0	5.4	5.9	3.20	2.95	3.40	3.70	3.55	2.95
28	7.6	7.0	3.90	4.2	5.4	5.6	3.20	2.95	3.50	3.60	3.50	2.90
29	7.6	.....	3.90	4.5	5.4	5.4	3.15	3.00	3.45	3.65	3.55	2.65
30	7.5	.....	3.80	4.5	5.2	5.4	3.05	3.00	3.45	3.70	3.55	6.3
31	7.4	.....	3.80	.....	5.3	.....	3.10	3.00	.....	3.65	.....	7.6

NOTE.—Gage heights Jan. 1 to Mar. 12 and Dec. 30 to 31 distorted by ice.

Daily discharge, in second-feet, of Missouri River at Toston, Mont., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,180	3,860	2,480	4,250	5,940	9,130	9,990	2,360	1,820	2,980	3,520	3,110
2	1,570	3,900	2,400	4,890	5,940	11,700	9,990	2,240	1,820	2,980	3,380	2,980
3	1,340	3,940	2,710	4,890	5,230	15,400	9,130	2,130	1,920	2,980	3,520	2,850
4	1,180	3,670	2,680	4,890	5,230	16,400	8,720	2,240	2,130	3,240	3,660	3,110
5	2,840	3,480	2,960	5,580	5,580	20,500	8,300	2,360	1,920	3,380	3,660	2,980
6	2,980	3,280	3,360	5,580	5,940	21,100	8,300	2,720	1,820	3,240	4,100	3,110
7	2,950	3,220	3,980	5,580	6,690	21,600	7,890	2,850	2,240	3,240	3,800	3,110
8	2,740	3,280	4,630	5,230	7,480	21,600	7,480	2,850	2,850	3,240	3,520	2,980
9	3,230	3,090	5,240	4,890	7,890	22,700	7,080	2,720	2,980	3,240	3,660	3,110
10	2,970	3,260	4,740	4,560	8,300	22,700	6,690	2,480	2,980	3,380	2,240	2,980
11	2,400	3,330	4,650	4,560	7,890	22,700	5,940	2,720	2,980	3,240	1,920	3,240
12	2,120	3,430	5,560	4,720	7,480	22,700	4,890	2,850	2,980	3,240	1,640	2,980
13	1,720	3,280	4,100	4,560	6,690	23,800	3,950	2,720	2,850	3,240	2,020	2,980
14	1,620	3,050	4,250	4,400	6,690	23,800	4,100	3,380	2,980	3,520	3,950	3,110
15	1,590	3,350	4,250	3,950	6,690	24,900	3,950	3,520	2,980	3,950	3,800	2,980
16	1,800	3,210	4,560	3,950	7,480	24,900	3,660	3,380	2,980	3,660	3,660	2,980
17	2,170	2,970	4,890	3,950	8,300	23,800	3,800	3,380	2,980	3,520	3,520	3,240
18	2,160	2,800	4,400	4,100	8,710	22,700	3,240	3,240	3,110	3,520	4,100	3,110
19	2,400	2,890	4,250	3,950	8,300	21,600	3,110	3,110	2,980	3,520	4,560	2,600
20	2,820	2,830	4,400	4,250	8,300	20,500	3,110	2,240	2,980	3,800	4,250	2,480
21	3,110	2,590	4,560	4,250	8,300	20,500	3,110	1,820	2,720	3,660	3,800	2,720
22	3,090	2,470	4,560	4,400	7,480	20,500	2,980	1,820	2,980	3,520	4,100	2,850
23	3,060	2,460	4,890	4,560	7,080	18,900	2,980	1,820	2,980	3,520	4,100	2,980
24	3,020	2,540	4,890	5,230	7,480	17,400	3,110	2,020	2,850	3,660	3,950	3,240
25	2,780	2,640	4,890	5,230	8,300	16,400	2,720	1,820	2,720	3,950	3,520	2,240
26	3,270	2,520	4,890	4,890	9,990	13,500	2,480	1,920	2,980	3,800	3,380	2,020
27	3,080	2,300	4,250	4,560	9,990	12,200	2,360	1,820	2,850	3,660	3,240	1,820
28	3,080	2,410	4,250	5,230	9,990	10,800	2,360	1,820	3,110	3,380	3,110	1,730
29	3,040	.....	4,250	6,310	9,990	9,990	2,240	1,920	2,980	3,520	3,240	1,350
30	3,300	.....	3,950	6,310	9,130	9,990	2,020	1,920	2,980	3,660	3,240	1,350
31	3,390	.....	3,950	.....	9,560	.....	2,130	1,920	.....	3,520	.....	1,350

NOTE.—Daily discharge determined from a well-defined rating curve. Daily discharge Jan. 1 to Mar. 12 is record of flow at Canyon Ferry dam.

Monthly discharge of Missouri River at Toston, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	3,390	1,180	2,550	157,000	C.
February	3,940	2,300	3,070	170,000	C.
March	5,560	2,400	4,190	258,000	C.
April	6,310	3,950	4,790	285,000	B.
May	9,990	5,230	7,680	472,000	B.
June	24,900	9,130	18,800	1,120,000	B.
July	9,990	2,020	4,900	301,000	B.
August	3,520	1,820	2,460	151,000	B.
September	3,110	1,820	2,710	161,000	B.
October	3,950	2,980	3,450	212,000	B.
November	4,560	1,640	3,470	206,000	B.
December	3,240	1,350	2,700	166,000	B.
The year	24,900	1,180	5,060	3,660,000	

MISSOURI RIVER AT CASCADE, MONT.

Location.—At the highway bridge, 100 yards from the Great Northern Railway, on the east side of the town of Cascade, Mont.

Records available.—July 20, 1902, to December 31, 1911.

Drainage area.—18,300 square miles.

Gage.—Standard chain gage attached to the bridge; datum unchanged.

Channel.—Probably permanent except at extreme flood stages.

Discharge measurements.—Made from lower side of bridge.

Winter flow.—Affected by ice.

The most important tributaries between this station and the station at Toston, above, are Dearborn River, Little Prickly Pear Creek, and Prickly Pear Creek. Although irrigation is extensively practiced in the Missouri River valley, the water is taken from the tributary streams, the Missouri itself because of its high banks and great variation in flow and difficulty of diversion being little used.

Discharge measurements of Missouri River at Cascade, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 2	C. S. Heidel	Ice.	3,020	June 22	B. E. Jones	9.88	23,000
Apr. 10	J. C. Beebe	5.40	6,440	July 12	do	5.90	7,660
10	do	5.35	6,320	Aug. 16	J. C. Beebe	4.53	3,980
May 23	B. E. Jones	5.98	8,710	Sept. 23	R. Richards	4.54	3,950
24	do	6.48	10,100	Oct. 14	W. A. Lamb	4.80	4,420

Daily gage height, in feet, of Missouri River at Cascade, Mont., for 1911.

[W. W. Doan, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		5.5	5.7	7.1	7.0	3.8	3.95	4.45	4.9	4.6
2		5.5	5.7	7.0	7.0	3.8	3.85	4.6	4.9	4.6
3		5.6	5.7	7.3	7.0	3.95	3.8	4.6	4.8	4.5
4		5.6	5.8	8.0	7.1	4.2	3.9	4.6	4.9	4.45
5		5.5	5.4	8.4	7.1	4.2	4.15	4.6	4.8	4.45
6		5.6	5.4	8.9	7.0	4.15	4.3	4.6	4.8	4.35
7		5.7	5.1	9.3	6.8	4.2	4.1	4.8	4.8	4.35
8		5.5	5.4	9.7	6.6	4.35	4.0	4.8	4.8	4.25
9		5.5	5.8	10.0	6.3	4.25	3.75	4.8	4.8	4.35
10		5.5	6.6	10.0	6.2	4.5	3.8	4.6	5.0	4.45
11		5.4	6.7	10.1	6.0	4.5	3.85	4.8	6.8	4.45
12		5.4	6.7	10.1	5.8	4.4	3.95	4.8	7.2	4.45
13		5.3	6.1	10.3	5.6	4.4	3.8	4.8	6.2	4.6
14		5.3	6.1	10.3	5.8	4.25	4.15	4.8	5.4	5.0
15		5.3	6.2	10.4	4.8	4.6	3.9	4.8	5.7	4.7
16		5.3	6.2	10.7	4.5	4.6	3.8	4.8	5.6	4.6
17		5.0	5.6	10.9	4.35	4.25	4.3	4.9	5.8	4.6
18	5.6	5.0	4.7	10.7	4.45	4.5	4.35	4.8	6.0	4.6
19	5.5	5.3	3.4	10.6	4.4	4.6	4.5	4.9	6.2	4.7
20	5.4	5.1	3.1	10.2	4.5	4.5	4.45	4.9	6.6	4.6
21	5.4	5.3	3.05	9.9	4.35	4.4	4.45	4.8	8.2	4.3
22	5.3	5.3	4.8	10.1	4.1	4.3	4.4	4.8	6.6	4.4
23	5.4	5.3	6.0	9.7	4.0	4.05	4.4	4.9	5.7	5.0
24	5.4	5.2	6.4	9.4	3.95	3.8	4.35	4.9	5.2	5.6
25	5.3	5.5	6.2	9.2	4.05	3.8	4.35	4.9	5.3	6.2
26	5.3	5.5	6.6	8.9	4.2	3.75	4.25	4.8	5.4	6.7
27	5.3	5.6	7.0	8.3	4.3	3.9	4.15	4.8	5.2	6.3
28	5.4	5.6	7.2	7.9	4.25	4.0	4.35	4.8	5.4	6.4
29	5.4	5.6	7.1	7.5	4.2	3.95	4.4	4.8	5.2	5.0
30	5.5	5.6	7.2	7.4	3.95	3.9	4.4	4.8	4.8	6.0
31	5.5		7.1		3.95	3.9		4.9		6.4

NOTE.—Gage heights Nov. 10 to 30 and Dec. 23 to 31 distorted by ice. Low readings May 18 to 22 caused by closing of gates at Hauser Lake dam.

Daily discharge, in second-feet, of Missouri River at Cascade, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	6,760	7,400	12,400	11,600	2,260	2,580	3,760	4,650	3,850
2	.....	6,760	7,400	12,000	11,600	2,260	2,360	4,150	4,650	3,850
3	.....	7,080	7,400	13,100	11,600	2,580	2,260	4,150	4,380	3,590
4	.....	7,080	7,730	15,800	12,000	3,140	2,470	4,150	4,650	3,460
5	.....	6,760	6,450	17,300	12,000	3,140	3,020	4,150	4,380	3,460
6	.....	7,080	6,450	19,200	11,600	3,020	3,380	4,150	4,380	3,220
7	.....	7,400	5,560	20,800	10,900	3,140	2,910	4,380	4,380	3,220
8	.....	6,760	6,450	22,300	10,100	3,500	2,690	4,380	4,380	2,980
9	.....	6,760	7,730	23,500	9,040	3,260	2,160	4,380	4,380	3,220
10	.....	6,760	10,500	23,500	8,690	3,890	2,260	3,850	4,350	3,460
11	.....	6,450	10,900	23,900	8,000	3,890	2,360	4,380	4,320	3,460
12	.....	6,450	10,900	23,900	7,340	3,630	2,580	4,380	4,290	3,460
13	.....	6,150	8,740	24,700	6,700	3,630	2,260	4,380	4,260	3,850
14	.....	6,150	8,740	24,700	7,340	3,260	3,020	4,380	4,230	4,930
15	.....	6,150	9,080	25,100	4,380	4,150	2,470	4,380	4,200	4,110
16	.....	6,150	9,080	26,400	3,590	4,150	2,260	4,380	4,170	3,850
17	.....	5,270	7,080	27,200	3,220	3,260	3,380	4,650	4,140	3,850
18	7,080	5,270	4,420	26,400	3,460	3,890	3,500	4,380	4,110	3,850
19	6,760	6,150	1,510	26,000	3,340	4,150	3,890	4,650	4,090	4,110
20	6,450	5,560	1,040	24,300	3,590	3,890	3,760	4,650	4,070	3,850
21	6,450	6,150	965	23,100	3,220	3,630	3,760	4,380	4,050	3,100
22	6,150	6,150	4,700	23,900	2,630	3,380	3,630	4,380	4,030	3,340
23	6,450	6,150	8,400	22,300	2,410	2,800	3,630	4,650	4,010	3,200
24	6,450	5,850	9,780	21,100	2,300	2,260	3,500	4,650	3,990	3,100
25	6,150	6,760	9,080	20,300	2,520	2,260	3,500	4,650	3,970	3,000
26	6,150	6,760	10,500	19,100	2,860	2,160	3,260	4,380	3,950	2,900
27	6,150	7,080	12,000	16,700	3,100	2,470	3,020	4,380	3,930	2,800
28	6,450	7,080	12,800	15,200	3,260	2,690	3,500	4,380	3,910	2,700
29	6,450	7,080	12,400	13,600	3,140	2,580	3,630	4,380	3,890	2,600
30	6,760	7,080	12,800	13,200	2,580	2,470	3,630	4,380	3,870	2,500
31	6,760	.....	12,400	.....	2,580	2,470	.....	4,650	.....	2,400

NOTE.—Daily discharge determined from rating curves as follows: June 18 to July 27 and Oct. 7 to Dec. 31, fairly well defined between 2,410 and 23,500 second-feet; Mar. 18 to June 17 and July 28 to Oct. 6, fairly well defined between 3,500 and 23,500 second-feet.

Monthly discharge of Missouri River at Cascade, Mont., for 1911.

[Drainage area, 18,300 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a] 3,200	0.175	0.20	197,000	D.
February	.....	.....	[a] 3,700	.202	.21	205,000	D.
March	7,080	.....	5,670	.310	.36	349,000	C.
April	7,400	5,270	6,500	.355	.40	387,000	B.
May	12,800	965	8,080	.442	.51	497,000	B.
June	27,200	12,000	20,700	1.13	1.26	1,230,000	B.
July	12,000	2,300	6,150	.336	.39	378,000	B.
August	4,150	2,160	3,140	.172	.20	193,000	B.
September	3,890	2,160	3,020	.165	.18	180,000	B.
October	4,650	3,760	4,370	.239	.28	269,000	B.
November	4,650	3,870	4,200	.230	.26	250,000	C.
December	4,930	2,400	3,400	.186	.21	209,000	C.
The year	27,200	965	6,000	.328	4.46	4,340,000	

[a] Estimated from records obtained at Canyon Ferry dam.

NOTE.—Discharge Mar. 1 to 17 estimated at 5,000 second-feet per day.

MISSOURI RIVER AT FORT BENTON, MONT.

Location.—At the public highway bridge at Fort Benton, Mont.

Records available.—July 1, 1902, to April 27, 1910, gage heights recorded by United States Weather Bureau; April 28, 1910, to December 31, 1910, United States Geological Survey records, including partial estimates of run-off for the year 1910.

Drainage area.—112,000 square miles.

Gage.—A Mott gage installed April 11, 1907, on upstream side of bridge; datum unchanged.

Channel.—Probably permanent except in flood.

Discharge measurements.—Made from downstream side of bridge.

Winter flow.—Affected by ice.

Accuracy.—No estimates are made for 1911 as gage heights are in error and are not published.

Discharge measurements of Missouri River at Fort Benton, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 10	W. A. Lamb	1.95	7,240	July 9	J. C. Beebe	3.38	13,100
10	do	1.95	7,170	25	do	.93	4,130
May 31	J. C. Beebe	3.84	15,000	Aug. 30	R. Richards	.77	3,680

TRIBUTARY BASINS.

BIGHOLE RIVER BASIN.

BIGHOLE RIVER NEAR DEWEY, MONT.

Location.—In sec. 36, T. 1 N., R. 11 W., at Young's bridge, 4 miles above Dewey and 11 miles above Divide, Mont.; a few miles below the mouth of Wise River.

Records available.—September 15 to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff fastened to southeast piling of bridge on downstream side.

Channel.—Rocky and clean; nonshifting.

Discharge measurements.—Made from bridge.

Winter flow.—Affected by ice.

Diversions.—Water is diverted from this stream for irrigation.

Artificial control.—A large hydroelectric power plant is in operation about 8 miles below the station.

Discharge measurements of Bighole River near Dewey, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 21	C. S. Heidel	3.96	1,060
July 8	do	4.94	2,040
Sept. 18	do	2.26	280

Daily gage height, in feet, of Bighole River near Dewey, Mont., for 1911.

[W. T. Neal, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	4.4	4.9	.....	3.4	2.25	2.3	2.65	2.4
2	.....	.....	4.5	5.6	.....	3.3	2.3	2.3	2.6	2.35
3	.....	.....	4.3	6.5	.....	3.3	2.2	2.4	2.5	2.3
4	.....	.....	4.4	7.0	.....	3.4	2.25	2.5	2.5	2.3
5	.....	.....	4.9	7.4	.....	3.4	2.25	2.5	2.5	2.3
6	.....	.....	5.3	7.6	.....	3.6	2.3	2.5	2.45	2.25
7	.....	.....	4.9	7.8	.....	3.5	2.4	2.5	2.4	2.25
8	.....	.....	5.0	7.6	5.0	3.4	2.4	2.5	2.4	2.2
9	.....	.....	5.2	7.8	4.7	3.4	2.45	2.5	2.4	2.2
10	.....	.....	5.0	7.9	4.6	3.2	2.5	2.55	2.35	2.2
11	.....	.....	4.8	7.8	4.4	3.2	2.45	2.7	2.35	2.2
12	2.2	.....	4.7	7.6	4.3	3.2	2.5	3.0	2.4	2.2
13	2.2	.....	4.6	8.0	4.2	3.2	2.4	3.1	2.4	2.2
14	2.3	.....	4.6	.....	4.1	3.1	2.35	3.1	2.6	2.2
15	2.3	.....	5.1	.....	.....	3.0	2.3	3.1	2.65	2.2
16	2.4	.....	5.4	.....	4.0	3.0	2.2	3.1	2.65	.....
17	2.4	.....	5.5	.....	4.0	2.95	2.25	3.1	2.7	.....
18	2.4	.....	5.5	.....	4.0	2.9	2.2	3.1	2.65	.....
19	2.45	.....	5.3	.....	3.9	2.85	2.2	3.1	2.7	.....
20	2.5	.....	5.1	.....	3.8	2.8	2.2	3.1	2.7	.....
21	2.5	4.0	4.7	.....	3.8	2.8	2.2	3.1	2.6	.....
22	2.6	4.4	4.7	.....	3.8	2.7	2.2	3.1	2.6	.....
23	2.7	4.4	4.7	.....	3.7	2.6	2.2	3.0	2.6	.....
24	2.8	4.4	4.8	.....	3.6	2.55	2.2	3.1	2.5	.....
25	2.8	4.5	4.8	.....	3.6	2.55	2.2	3.0	2.45	.....
26	2.8	4.7	4.8	.....	3.5	2.45	2.2	2.95	2.4	.....
27	2.8	5.0	4.7	.....	3.5	2.45	2.2	3.0	2.4	.....
28	2.8	5.0	4.6	.....	3.4	2.35	2.2	2.9	2.4	.....
29	2.85	5.0	4.6	.....	3.4	2.4	2.25	2.9	2.4	.....
30	2.95	5.0	4.6	.....	3.4	2.35	2.25	2.8	2.35	.....
31	3.2	.....	4.6	.....	3.4	2.25	.....	2.65	2.3	.....

Daily discharge, in second-feet, of Bighole River near Dewey, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	680	1,440	1,900	4,560	755	265	280	410	315
2	.....	700	1,530	2,740	4,190	705	280	280	390	298
3	.....	725	1,360	4,080	3,820	705	250	315	350	280
4	.....	750	1,440	4,950	3,460	755	265	350	350	280
5	.....	775	1,900	5,670	3,100	755	265	350	350	280
6	.....	800	2,330	6,030	2,730	870	280	350	332	265
7	.....	825	1,900	6,390	2,360	810	315	350	315	265
8	.....	850	2,000	6,030	2,000	755	315	350	315	250
9	.....	875	2,210	6,390	1,720	755	332	350	315	250
10	.....	900	2,000	6,570	1,620	655	350	370	298	250
11	.....	925	1,810	6,390	1,440	655	332	430	298	250
12	250	950	1,720	6,030	1,360	655	350	560	315	250
13	250	975	1,620	6,750	1,280	655	315	605	315	250
14	280	1,000	1,620	7,650	1,200	605	298	605	390	250
15	280	1,020	2,100	8,100	1,160	560	280	605	410	250
16	315	1,050	2,460	8,550	1,130	560	250	605	410	.....
17	315	1,070	2,600	10,400	1,130	538	265	605	430	.....
18	315	1,090	2,600	9,780	1,130	515	250	605	410	.....
19	332	1,100	2,330	9,160	1,060	492	250	605	430	.....
20	350	1,120	2,100	8,550	1,000	470	250	605	430	.....
21	350	1,130	1,720	8,200	1,000	470	250	605	390	.....
22	390	1,440	1,720	7,840	1,000	430	250	605	390	.....
23	430	1,440	1,720	7,480	935	390	250	560	390	.....
24	470	1,440	1,810	7,110	870	370	250	605	350	.....
25	470	1,530	1,810	6,740	870	370	250	560	332	.....
26	470	1,720	1,810	6,380	810	332	250	538	315	.....
27	470	2,000	1,720	6,010	810	332	250	560	315	.....
28	470	2,000	1,620	5,650	755	298	250	515	315	.....
29	492	2,000	1,620	5,280	755	315	265	515	315	.....
30	538	2,000	1,620	4,920	755	298	265	470	298	.....
31	655	.....	1,620	.....	755	265	.....	410	280	.....

NOTE.—Daily discharge determined from a rating curve that is fairly well defined below 2,600 second-feet. Discharge estimated as follows: June 14, 7,650 second-feet; June 16, 8,550 second-feet; June 17, 10,400 second-feet; June 20, 8,550 second-feet. Discharge interpolated for all other days on which gage heights are missing.

Monthly discharge of Bighole River near Dewey, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	a 300	18,400	
February	.....	.....	a 250	13,900	
March	655	.....	343	21,100	C.
April	2,000	680	1,160	69,000	C.
May	2,600	1,360	1,870	115,000	B.
June	10,400	1,900	6,590	392,000	C.
July	4,560	755	1,640	101,000	C.
August	870	265	551	33,900	B.
September	350	250	276	16,400	B.
October	605	280	488	30,000	B.
November	430	280	365	21,700	B.
December	315	.....	245	15,100	C.
The year	10,400	.....	1,170	848,000	

a Estimated.

NOTE.—Discharge Mar. 1 to 11 estimated at 250 second-feet per day; Dec. 16 to 31, 225 second-feet per day.

RUBY RIVER BASIN.

RUBY RIVER NEAR ALDER, MONT.

Location.—At the private bridge on Lauterbach's ranch, about 8 miles south of Alder, Mont.

Records available.—April 27, 1911, to December 31, 1911.

Drainage area.—About 540 square miles.

Gage.—Vertical staff spiked to bridge pile 4 feet from right bank.

Channel.—Probably permanent, or only slightly shifting. Bed of stream below the gage composed of gravel and pebbles. At the gage the water is deeper and the material of the bed is finer.

Discharge measurements.—At low and ordinary stages made by wading on riffle at control 200 feet below gage; high-stage measurements made from downstream side of bridge.

Winter flow.—Affected by ice.

Discharge measurements of Ruby River near Alder, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 28	C. S. Heidel	4.18	189
June 12	do	5.75	711
July 14	do	4.08	158
Sept. 15	do	3.89	116

Daily gage height, in feet, of Ruby River near Alder, Mont., for 1911.

[Leo Hadel, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	4.0	5.4	4.7	4.0	3.8	4.0	4.0
2	.....	4.1	5.5	4.7	4.1	3.7	4.0	4.0
3	.....	4.1	5.6	4.6	4.0	3.7	4.1	4.0
4	.....	4.3	6.3	4.6	4.0	3.7	4.0	4.0
5	.....	4.5	6.3	4.5	4.1	3.8	4.0	4.0
6	.....	5.1	6.2	4.4	4.3	3.8	4.0	4.0
7	.....	4.6	.....	4.4	4.3	3.8	4.0	4.0
8	.....	4.7	.....	4.4	4.2	3.8	4.0	4.0
9	.....	4.5	6.3	4.3	4.2	3.8	4.0	4.0
10	.....	4.6	5.8	4.2	4.2	3.8	4.0	4.0
11	.....	4.5	6.0	4.2	4.1	3.8	4.0	4.0
12	.....	4.6	5.8	4.1	4.1	3.8	4.0	4.0
13	.....	4.5	6.1	4.1	4.1	4.0	4.1	4.0
14	.....	4.9	6.1	4.1	4.1	4.0	4.0	4.0
15	.....	5.2	5.9	4.1	4.1	3.9	4.0	4.0
16	.....	5.0	5.7	4.0	4.1	3.9	4.0	4.0
17	.....	4.8	5.5	4.0	4.1	3.9	4.0	4.0
18	.....	4.6	5.4	4.0	4.0	3.9	4.0	4.0
19	.....	4.7	5.3	4.0	4.0	3.9	3.9	4.0
20	.....	4.5	5.3	4.0	4.0	3.9	3.9	4.0
21	.....	4.5	5.4	4.0	4.0	4.0	4.0	4.0
22	.....	4.5	5.1	4.0	3.9	3.9	4.0	3.9
23	.....	5.3	4.9	4.0	3.9	3.9	4.0	3.9
24	.....	5.6	4.8	4.0	3.9	4.0	4.0	3.9
25	.....	5.2	4.7	4.0	3.9	4.0	4.0	3.9
26	.....	5.2	4.7	4.0	3.9	4.0	4.0	3.9
27	.....	5.4	4.7	4.1	3.8	4.0	4.0	3.9
28	4.2	5.4	4.7	4.0	3.8	4.0	4.0	3.9
29	4.1	5.3	4.8	4.0	3.8	4.0	3.9	3.9
30	4.0	5.0	4.8	4.0	3.8	4.0	3.9	3.9
31	.....	5.1	.....	4.0	3.8	.....	3.9	.....

Daily discharge, in second-feet, of Ruby River near Alder, Mont., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	141	579	340	141	95	141	141
2	.....	166	615	340	166	76	141	141
3	.....	166	652	308	141	76	166	141
4	.....	219	920	308	141	76	141	141
5	.....	277	920	277	166	95	141	141
6	.....	472	880	247	219	95	141	141
7	.....	308	895	247	219	95	141	141
8	.....	340	910	247	192	95	141	141
9	.....	277	920	219	192	95	141	141
10	.....	308	726	192	192	95	141	141
11	.....	277	802	192	166	95	141	141
12	.....	308	726	166	166	95	141	141
13	.....	277	840	166	166	141	166	141
14	.....	405	840	166	166	141	141	141
15	.....	507	764	166	166	117	141	141
16	.....	438	689	141	166	117	141	141
17	.....	372	615	141	166	117	141	141
18	.....	308	579	141	141	117	141	141
19	.....	340	543	141	141	117	117	141
20	.....	277	543	141	141	117	117	141
21	.....	277	579	141	141	141	141	141
22	.....	277	472	141	117	117	141	117
23	.....	543	405	141	117	117	141	117
24	.....	652	372	141	117	141	141	117
25	.....	507	340	141	117	141	141	117
26	.....	507	340	141	117	141	141	117
27	.....	579	340	166	95	141	141	117
28	192	579	340	141	95	141	141	117
29	166	543	372	141	95	141	117	117
30	141	438	372	141	95	141	117	117
31	.....	472	.....	141	95	.....	117	.....

NOTE.—Daily discharge determined from a fairly well-defined rating curve.

Monthly discharge of Ruby River near Alder, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	652	141	373	22,900	B.
June	920	340	630	37,500	B.
July	340	141	189	11,600	B.
August	219	95	147	9,040	B.
September	141	76	114	6,780	B.
October	166	117	139	8,550	B.
November	141	117	134	7,970	B.
December	.....	.....	[a] 100	6,150	D.
The period	.....	.....	.....	110,000	

[a] Estimated.

PIPESTONE CREEK BASIN.

PIPESTONE CREEK NEAR WHITEHALL, MONT.

Location.—Six miles west of Whitehall, Mont., at Peyton Allred's ranch, a short distance above junction of Pipestone and Little Pipestone creeks.

Records available.—October 13, 1910, to September 30, 1911.

Gage.—Staff fastened securely to a large post on the left bank of the stream directly north of the observer's house.

Channel.—Sandy and shifting.

Cooperation.—Gage heights and discharge measurements supplied by G. E. Baker.

Discharge measurements of Pipestone Creek near Whitehall, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 9	Baker and Bell	0.68	12.9	Apr. 20	Baker and Bell	1.00	24.3
Mar. 9	do	.66	12.2	July 16	C. S. Heidel	1.00	2.47
Apr. 19	do	1.03	26.4	16	G. E. Baker	1.01	2.27

Daily gage height, in feet, and discharge, in second-feet, of Pipestone Creek near Whitehall, Mont., for 1910.

[Mrs. Payton Allred, observer.]

Day.	October.		November.		December.		Day.	October.		November.		December.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	.....	0.6	5	0.85	15	16	0.5	2.5	0.5	3.5	0.7	10
2	.....	.....	.6	5	.8	13	17	.5	2.5	.7	10	.75	13
3	.....	.....	.6	5	.8	13	18	.55	3.5	.8	13	.75	13
4	.....	.....	.55	3.5	.85	15	19	.55	3.5	.8	13	.75	13
5	.....	.....	.5	2.5	.85	15	20	.55	3.5	.8	13	.7	11
6	.....	.....	.55	3.5	.9	16	21	.5	2.5	.8	13	.7	11
7	.....	.....	.55	3.5	.9	16	22	.5	2.5	.8	13	.7	11
8	.....	.....	.6	5	.85	15	23	.5	2.5	.8	13	.7	11
9	.....	.....	.6	5	.85	15	24	.5	2.5	.75	12	.7	11
10	.....	.....	.6	5	.8	13	25	.55	3.5	.75	12	.7	11
11	.....	.....	.6	5	.8	13	26	.55	3.5	.75	12	.7	11
12	.....	.....	.6	6.5	.8	13	27	.55	3.5	.75	12	.7	11
13	0.5	2.5	.6	6.5	.75	12	28	.55	3.5	.8	13	.7	11
14	.5	2.5	.5	3.5	.75	12	29	.55	3.5	.8	13	.7	11
15	.5	2.5	.5	3.5	.7	10	30	.55	3.5	.85	15	.7	11
							31	.55	3.5	.....	.....	.7	11

Daily gage height, in feet, of Pipestone Creek near Whitehall, Mont., for 1911.

[Mrs. Payton Allred, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.6	0.85	1.2	1.8	1.7	1.0	0.9	16	0.7	0.8	1.5	1.8	1.0	0.95	0.95
2	.6	.9	1.2	2.1	1.3	1.1	.9	17	.7	.85	1.4	1.9	1.0	.95	.....
3	.6	.9	1.1	1.7	1.6	1.1	.9	18	.7	.85	1.3	1.8	1.0	.95	.....
4	.6	.85	1.1	1.8	1.3	1.15	.9	19	.75	.85	1.3	1.8	.95	.95	.....
5	.6	.8	1.15	2.0	1.3	1.2	.95	20	.75	.9	1.25	2.2	.95	.9	.....
6	.7	.75	1.5	1.8	1.2	1.2	.95	21	.8	.9	1.25	2.0	1.0	.9	.....
7	.7	.75	1.2	1.9	1.2	1.0	1.0	22	.85	1.0	1.2	1.8	1.0	.9	.....
8	.7	.75	1.25	1.9	1.1	1.0	.95	23	.95	1.0	1.35	1.65	1.0	.9	.....
9	.65	.75	1.4	2.2	1.0	1.0	.95	24	.95	1.0	1.4	1.55	1.0	.9	.....
10	.65	.75	1.2	1.8	1.0	1.0	.95	25	.85	1.0	1.5	1.5	.95	.95	.....
11	.65	.75	1.2	1.8	1.0	1.0	.95	26	.75	1.0	1.5	1.5	.95	.95	.....
12	.7	.75	1.2	1.8	1.0	.95	.95	27	.75	1.5	1.5	1.5	.95	.95	.....
13	.7	.8	1.2	1.8	1.0	.95	.95	28	.75	1.45	1.5	1.5	.95	.95	.....
14	.7	.8	1.2	1.8	1.0	.95	.95	29	.75	1.2	1.5	1.5	1.0	.9	.....
15	.7	.8	1.4	1.8	1.0	.95	.95	30	.8	1.0	1.5	1.6	1.0	.9	.....
								31	.8	.....	1.5	.....	1.0	.9	.....

Daily discharge, in second-feet, of Pipestone Creek near Whitehall, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	10	19	33	67	33	2.5	0.5	16	13	17	49	53	2.5	1.5	1.5
2	10	21	33	87	17	5.0	.5	17	13	19	43	58	2.5	1.5	.....
3	10	21	29	61	28	5.0	.5	18	13	19	38	49	2.5	1.5	.....
4	10	19	29	67	15	6.5	.5	19	15	19	38	49	1.5	1.5	.....
5	10	17	31	80	15	8.0	1.5	20	15	21	36	73	1.5	.5	.....
6	13	15	49	63	11	8.0	1.5	21	17	21	36	61	2.5	.5	.....
7	13	15	33	71	11	2.5	2.5	22	19	25	33	45	2.5	.5	.....
8	13	15	36	71	7	2.5	1.5	23	23	25	40	37	2.5	.5	.....
9	12	15	43	87	4	2.5	1.5	24	23	25	43	33	2.5	.5	.....
10	12	15	33	57	4	2.5	1.5	25	19	25	49	30	1.5	1.5	.....
11	12	15	33	57	4	2.5	1.5	26	15	25	49	27	1.5	1.5	.....
12	13	15	33	57	2.5	1.5	1.5	27	15	49	49	27	1.5	1.5	.....
13	13	17	33	57	2.5	1.5	1.5	28	15	46	49	27	1.5	1.5	.....
14	13	17	33	53	2.5	1.5	1.5	29	15	33	49	27	2.5	.5	.....
15	13	17	43	53	2.5	1.5	1.5	30	17	25	49	29	2.5	.5	.....
								31	17	.....	49	.....	2.5	.5	.....

NOTE.—Daily discharge determined as follows: Oct. 13,1910, to June 5, 1911, from curve fairly well defined below 35 second-feet; June 6 to July 15, by indirect method for shifting channels; July 16 to Sept. 16, from curve drawn parallel to other curve but poorly defined.

Monthly discharge of Pipestone Creek near Whitehall, Mont., for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
October 13–31	3.5	2.5	3.03	114	B.
November	15	2.5	8.28	493	B.
December	16	10	12.5	769	B.
1911.					
January	.....	.....	[a] 10	615	D.
February	.....	.....	[a] 12	666	D.
March	23	10	14.2	873	B.
April	49	15	21.6	1,290	B.
May	49	29	39.5	2,430	C.
June	87	27	53.8	3,200	C.
July	33	1.5	6.23	383	C.
August	8	.5	2.24	138	C.
September	1.5	.5	1.40	83.3	C.
The period	.....	.....	.....	9,680	

[a] Estimated.

NOTE.—Discharge Sept. 17 to 30 estimated at 1.5 second-feet per day.

WHITETAIL CREEK BASIN.

WHITETAIL CREEK AT WHITEHALL, MONT.

Location.—At highway bridge in the northeast part of the town.
Records available.—March 19 to June 30, 1911.
Drainage area.—Not measured.
Gage.—Staff gage nailed to pile on upstream side of bridge.
Channel.—Sandy; liable to shift.
Discharge measurements.—Made by wading at ordinary stages.
Winter flow.—Affected by ice.
Artificial control.—Water is diverted above the station for irrigation.
Cooperation.—Gage heights and discharge measurements supplied by G. E. Baker.

Discharge measurements of Whitetail Creek at Whitehall, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 28	Geo. E. Baker	2.35	14.9	Apr. 22	Geo. E. Baker	4.42	66.3
Apr. 8	do	2.80	24.8	26	do	5.11	96.9
19	do	4.59	75.5	27	do	5.66	123.4
20	do	3.88	50.9	July 16[b]	Baker and Heidel	1.57	0.6

[b] Estimated.

Daily gage height, in feet, and discharge, in second-feet, of Whitetail Creek at Whitehall, Mont., for 1911.

[G. E. Baker, observer.]

Day.	March.		April.		May.		June.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			2.44	17	3.80	48	2.80	24
2			2.50	18	3.50	39	3.70	45
3			2.50	18	3.55	40	4.70	80
4			2.75	23	3.50	39	4.80	84
5			2.45	17	3.90	51	5.10	96
6			3.00	28	4.50	72	5.10	96
7			2.90	26	3.50	39	4.05	56
8			2.80	24	3.75	46	3.75	46
9			2.90	26	3.30	34	4.00	54
10			2.95	27	3.20	32	3.80	48
11			2.80	24	2.85	25	3.40	36
12			2.65	21	2.45	17	2.90	26
13			2.85	25	2.45	17	2.80	24
14			2.60	20	2.40	16	2.70	22
15			2.45	17	2.30	14	2.50	18
16			2.40	16	4.00	54	2.40	16
17			3.00	28	3.95	52	2.30	14
18			2.67	21	3.40	36	2.20	12
19	2.50	18	4.61	76	3.00	28	2.10	10
20	2.55	19	3.88	50	2.80	24	2.20	12
21	2.60	20	4.70	80	2.70	22	2.30	14
22	2.50	18	4.42	69	2.50	18	2.40	16
23	2.60	20	3.70	45	2.40	16	2.50	18
24	2.60	20	3.65	44	2.50	18	2.30	14
25	2.50	18	3.85	50	3.40	36	2.30	14
26	2.30	14	5.11	96	3.75	46	2.20	12
27	2.40	16	5.67	124	3.50	39	2.50	18
28	2.35	15	5.10	96	3.60	42	2.30	14
29	2.35	15	4.50	72	3.70	45	2.20	12
30	2.40	16	3.90	51	3.45	38	2.30	14
31	2.30	14			3.00	28		

NOTE.—Daily discharge determined from a well-defined rating curve.

Monthly discharge of Whitetail Creek at Whitehall, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March 19-31	20	14	17.1	440	A.
April	124	16	41.6	2,480	A.
May	72	14	34.6	2,130	A.
June	96	10	32.2	1,920	A.

LITTLE WHITETAIL CREEK NEAR WHITEHALL, MONT.

Location.—At Collins's ranch, about 7 miles above Whitehall.
Records available.—March 17 to September 22, 1911.
Drainage area.—Not measured.
Gage.—Staff gage on right bank just above ford near the stables.
Channel.—Sandy and shifting.
Discharge measurements.—Made by wading at different sections.
Winter flow.—Is affected by ice.
Artificial control.—Water is diverted for irrigating.
Accuracy.—Fair. The shifting affects the results to some extent.
Cooperation.—Gage heights and discharge measurements supplied by G. E. Baker.

Discharge measurements of Little Whitetail Creek near Whitehall, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 7	Geo. E. Baker	1.06	4.7
Apr. 19	do	1.10	4.7
July 16	do	.92	1.8
16	C. S. Heidel	.94	2.0

Daily gage height, in feet, of Little Whitetail Creek near Whitehall, Mont., for 1911.

[Ella Collins, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1.20	1.20	1.20	0.80	0.90	1.00	16	1.10	1.20	1.20	1.10	.....	1.00	0.90
2	.....	1.20	1.20	1.30	.80	.90	1.00	17	1.00	1.20	1.10	1.00	.....	1.00	.90
3	.....	1.20	1.20	1.40	.80	.90	1.00	18	1.00	1.20	1.00	1.00	.....	1.00	.90
4	.....	1.20	1.10	1.30	.80	.90	1.00	19	1.00	1.10	1.00	1.00	.....	1.00	.90
5	.....	1.20	1.10	1.30	.80	.90	1.00	20	1.10	1.10	.90	1.00	.....	1.00	.90
6	.....	1.20	1.00	1.30	.80	.90	1.00	21	1.20	1.10	.90	1.00	.....	1.00	.90
7	1.10	1.20	1.00	1.20	.90	.90	1.00	22	1.30	1.10	.90	.90	.....	1.00	.90
8	1.10	1.20	1.10	1.30	.90	.90	1.00	23	1.20	1.10	.90	.90	0.90	1.00	.....
9	1.10	1.20	1.10	1.40	.80	.90	1.00	24	1.20	1.10	.90	.90	.90	1.10	.....
10	1.00	1.20	1.10	1.30	.80	1.00	.80	25	1.20	1.10	.90	.90	.90	1.10	.....
11	1.10	1.20	1.10	1.20	.80	1.00	.80	26	1.20	1.20	.90	.90	.90	1.10	.....
12	1.10	1.20	1.00	1.10	.90	1.00	.90	27	1.20	1.30	.90	.90	.90	1.00	.....
13	1.10	1.10	1.00	1.10	.....	1.00	.90	28	1.10	1.40	.90	.90	.90	1.00	.....
14	1.10	1.20	.80	1.10	.....	1.00	.90	29	1.10	1.30	.90	.80	.90	1.00	.....
15	1.10	1.10	.90	1.10	.....	1.00	1.00	30	1.10	1.20	.90	.80	.90	1.00	.....
								31	1.10	.....	.90	.....	.90	1.00	.....

Daily discharge, in second-feet, of Little Whitetail Creek near Whitehall, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1....	5.0	7.2	6.8	6.8	.6	1.5	2.9	16....	5.4	7.0	6.8	4.7	1.5	2.9	1.5
2....	5.0	7.2	6.8	9.1	.6	1.5	2.9	17....	3.3	7.0	4.7	2.9	1.5	2.9	1.5
3....	5.1	7.2	6.8	12.0	.6	1.5	2.9	18....	3.3	7.0	2.9	2.9	1.5	2.9	1.5
4....	5.2	7.2	4.7	9.1	.6	1.5	2.9	19....	3.3	4.8	2.9	2.9	1.5	2.9	1.5
5....	5.3	7.2	4.7	9.1	.6	1.5	2.9	20....	5.2	4.7	1.5	2.9	1.5	2.9	1.5
6....	5.4	7.2	2.9	9.1	.6	1.5	2.9	21....	7.3	4.7	1.5	2.9	1.5	2.9	1.5
7....	5.4	7.0	2.9	6.8	1.5	1.5	2.9	22....	9.7	4.7	1.5	1.5	1.5	2.9	1.5
8....	5.4	7.0	4.7	9.1	1.5	1.5	2.9	23....	7.3	4.7	1.5	1.5	1.5	2.9	1.5
9....	5.4	7.0	4.7	12.0	.6	1.5	2.9	24....	7.3	4.7	1.5	1.5	1.5	4.7	1.5
10....	3.5	7.0	4.7	9.1	.6	2.9	.6	25....	7.3	4.7	1.5	1.5	1.5	4.7	1.5
11....	5.4	7.0	4.7	6.8	.6	2.9	.6	26....	7.3	6.8	1.5	1.5	1.5	4.7	1.5
12....	5.4	7.0	2.9	4.7	1.5	2.9	1.5	27....	7.3	9.1	1.5	1.5	1.5	2.9	1.5
13....	5.4	4.8	2.9	4.7	1.5	2.9	1.5	28....	5.0	12.0	1.5	1.5	1.5	2.9	1.5
14....	5.4	7.0	.6	4.7	1.5	2.9	1.5	29....	5.0	9.1	1.5	.6	1.5	2.9	1.5
15....	5.4	4.8	1.5	4.7	1.5	2.9	2.9	30....	5.0	6.8	1.5	.6	1.5	2.9	1.5
								31....	5.0	.....	1.5	.....	1.5	2.9	.....

NOTE.—Daily discharge determined from a fairly well-defined rating curve Apr. 19 to end of season. Indirect method used Mar. 7 to Apr. 18. Discharge estimated Mar. 1 to 6, July 13 to 22, and Sept. 23 to 30.

Monthly discharge of Little Whitetail Creek near Whitehall, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March	9.7	3.3	5.54	341	C.
April	12	4.7	6.65	396	C.
May	6.8	.6	3.15	194	B.
June	12	.6	4.96	295	B.
July	1.5	.6	1.24	76.2	B.
August	4.7	1.5	2.67	164	B.
September	2.9	.6	1.89	112	B.
The period	.....	.....	.....	1,580	

GALLATIN RIVER BASIN.

WEST GALLATIN RIVER NEAR SALESVILLE, MONT.

Location.—On highway bridge 4 miles above Salesville, Mont., just below mouth of canyon. Above the station Spanish Creek is the most important tributary.

Records available.—July 18, 1895, to December 31, 1905; August 9 to December 31, 1910; and July to December, 1911.

Drainage area.—860 square miles.

Gage.—Standard chain, boxed and fastened near middle of bridge on upstream side; datum unchanged.

Channel.—Bed of stream is of gravel and small bowlders, and will not shift.

Discharge measurements.—Made from the lower side of the highway bridge.

Diversions.—Irrigation is practiced extensively on this stream, and practically the entire low-water flow of the river is appropriated.

Discharge measurements of West Gallatin River near Salesville, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
July 19	R. Richards	4.27	1,220
Aug. 22	C. S. Heidel	3.37	564
Nov. 8	B. E. Jones	3.17	425

Daily gage height, in feet, and discharge, in second-feet, of West Gallatin River near Salesville, Mont., for 1910.

[Mrs. James Gant, observer.]

Day.	Aug.		Sept.		Oct.		Nov.		Dec.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	475	3.1	390	3.1	390	3.25	452	3.2	430
2	.....	475	3.1	390	3.2	430	3.35	502	3.05	372
3	.....	475	3.1	390	3.2	430	3.25	452	3.05	372
4	.....	475	3.2	430	3.2	430	3.25	452	3.15	410
5	.....	475	3.2	430	3.3	475	3.2	430	3.0	355
6	.....	475	3.2	430	3.3	475	3.2	430	3.0	355
7	.....	475	3.2	430	3.3	475	3.2	430	3.05	372
8	.....	475	3.2	430	3.3	475	3.2	430	3.1	390
9	3.3	475	3.2	430	3.2	430	3.2	430	3.0	355
10	3.2	430	3.2	430	3.3	475	3.1	390	2.9	330
11	3.2	430	3.2	430	3.2	430	3.1	390	3.0	355
12	3.2	430	3.2	430	3.2	430	3.2	430	3.0	355
13	3.4	530	3.2	430	3.3	475	3.05	372	2.95	342
14	3.2	430	3.2	430	3.2	430	3.05	372	2.95	342
15	3.2	430	3.2	430	3.2	430	3.15	410	3.0	355
16	3.2	430	3.2	430	3.2	430	3.0	355	3.0	355
17	3.1	390	3.2	430	3.3	475	3.0	355	2.95	342
18	3.1	390	3.2	430	3.3	475	3.1	390	3.0	355
19	3.1	390	3.2	430	3.3	475	3.2	430	3.05	372
20	3.1	390	3.2	430	3.4	530	3.1	390	3.05	372
21	3.0	355	3.2	430	3.2	430	3.1	390	2.95	342
22	3.0	355	3.2	430	3.2	430	3.25	452	3.0	355
23	3.0	355	3.2	430	3.3	475	3.15	410	3.05	372
24	3.1	390	3.2	430	3.2	430	3.15	410	3.0	355
25	3.1	390	3.1	390	3.2	430	3.25	452	2.95	342
26	3.1	390	3.2	430	3.3	475	3.15	410	3.0	355
27	3.1	390	3.2	430	3.3	475	3.1	390	3.05	372
28	3.0	355	3.2	430	3.2	430	3.2	430	3.05	372
29	3.0	355	3.1	390	3.2	430	3.1	390	2.95	342
30	3.1	390	3.0	355	3.3	475	3.1	390	3.0	355
31	3.1	390	.....	.....	3.2	430	.....	.....	3.05	372

Daily gage height, in feet, and discharge, in second-feet, of West Gallatin River near Salesville, Mont., for 1911.

[C. L. Crew, observer.]

Day.	July.		Aug.		Sept.		Oct.		Nov.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	.....	3.75	762	3.25	452	3.25	452	3.05	372
2	.....	.....	3.90	880	3.30	475	3.30	475	3.10	390
3	.....	.....	3.75	762	3.25	452	3.25	452	3.05	372
4	.....	.....	3.80	800	3.30	475	3.30	475	3.20	430
5	.....	.....	3.75	762	3.35	502	3.25	452	3.15	410
6	.....	.....	3.80	800	3.35	502	3.25	452	3.15	410
7	.....	.....	3.75	762	3.40	530	3.30	475	3.20	430
8	.....	.....	3.80	800	3.35	502	3.25	452	3.05	372
9	.....	.....	3.70	725	3.40	530	3.30	475	3.10	390
10	.....	.....	3.65	690	3.25	452	3.25	452	3.05	372
11	.....	.....	3.70	725	3.25	452	3.25	452	.....	.....
12	.....	.....	3.60	655	3.30	475	3.30	475	.....	.....
13	.....	.....	3.60	655	3.35	502	3.25	452	.....	.....
14	.....	.....	3.55	622	3.40	530	3.30	475	.....	.....
15	.....	.....	3.55	622	3.35	502	3.25	452	.....	.....
16	.....	.....	3.50	590	3.35	502	3.25	452	.....	.....
17	.....	.....	3.45	560	3.30	475	3.30	475	.....	.....
18	.....	.....	3.45	560	3.25	452	3.25	452	.....	.....
19	4.30	1,240	3.35	502	3.30	475	3.30	475	.....	.....
20	4.25	1,190	3.35	502	3.25	452	3.25	452	.....	.....

Daily gage height, in feet, and discharge, in second-feet, of West Gallatin River near Salesville, Mont., for 1911—Continued.

Day.	July.		Aug.		Sept.		Oct.		Nov.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge	Gage height.	Discharge.
21	4.30	1,240	3.40	530	3.25	452	3.15	410	.....	.....
22	4.20	1,140	3.35	502	3.30	475	3.20	430	.....	.....
23	4.10	1,060	3.40	530	3.25	452	3.25	452	.....	.....
24	4.05	1,010	3.35	502	3.30	475	3.30	475	.....	.....
25	3.95	922	3.25	452	3.25	452	3.25	452	.....	.....
26	4.00	965	3.30	475	3.25	452	3.15	410	.....	.....
27	3.85	840	3.25	452	3.30	475	3.20	430	.....	.....
28	3.90	880	3.30	475	3.25	452	3.15	410	.....	.....
29	3.85	840	3.25	452	3.30	475	3.20	430	.....	.....
30	3.85	840	3.30	475	3.25	452	3.05	372	.....	.....
31	3.80	800	3.25	452	.....	.....	3.05	372	.....	.....

NOTE.—Daily discharge determined from a rating curve that is fairly well defined for all gage heights.

Monthly discharge of West Gallatin River near Salesville, Mont., for 1910–11.

[Drainage area, 860 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1910.							
August	530	355	421	0.490	0.56	25,900	B.
September	430	355	421	.490	.55	25,100	B.
October	530	390	451	.524	.60	27,700	B.
November	502	355	414	.481	.54	24,600	B.
December	430	330	362	.421	.49	22,300	B.
1911.							
July 19–31	1,240	800	997	1.16	.56	25,700	B.
August	880	452	614	.714	.82	37,800	B.
September	530	452	477	.555	.62	28,400	B.
October	475	372	447	.520	.60	27,500	B.
November	.....	.....	382	.444	.50	22,700	C.
December	.....	.....	325	.378	.44	20,000	D.

NOTE.—Discharge Aug. 1 to 8, 1910, estimated at 475 second-feet.
NOTE.—Mean for December estimated; mean for period Nov. 11 to 30 estimated at 375 second-feet.

DEEP CREEK BASIN.

DEEP CREEK NEAR TOWNSEND, MONT.

Location.—In sec. 29, T. 7 N., R. 4 E., Montana principal meridian, unsurveyed, 12 miles from Townsend, directly back of the ranger station in the canyon of Deep Creek, approximately 10 miles above the confluence with the Missouri River.

Records available.—October 9, 1910, to June 30, 1911.

Drainage area.—89 square miles.

Gage.—Vertical staff.

Channel.—Small rock; probably permanent.

Discharge measurements.—Made by wading.

Winter flow.—Affected by ice.

Diversion.—Small quantities of water are diverted for irrigation on small flats above the gage. Below the gage, nearly the entire flow is diverted, or will eventually be diverted, for irrigation on the land adjoining this creek and Missouri River.

Discharge measurements of Deep Creek near Townsend, Mont., in 1910–11.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
1910. Oct. 30	John C. Beebe	0.78	17.4
1911. May 12	F. E. Bonner	1.29	45

Daily gage height, in feet, of Deep Creek near Townsend, Mont., for 1910.

[D. N. Maryott, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	0.76	.....	0.71	16	.....	0.75	0.71	0.69
2	.....	.....	0.71	.71	17	.....	.74	.71	.69
3	.....	.....	.71	.71	18	.....	.73	.71	.68
4	.....	.....	.71	.70	19	.....	.73	.71	.68
5	.....	.....	.72	.70	20	.....	.72	.71	.66
6	.....	.....	.72	.70	21	.....	.72	.71	.66
7	.....	.....	.71	.70	22	.....	.72	.71	.65
8	.....	.....	.71	.70	23	.....	.72	.71	.65
9	.....	.75	.71	.70	24	.....	.71	.71	.65
10	.....	.75	.71	.70	25	.....	.72	.71	.....
11	.....	.76	.71	.70	26	.....	.73	.72	.....
12	.....	.76	.71	.70	27	.....	.73	.72	.....
13	.....	.76	.71	.70	28	.....	.72	.71	.....
14	.....	.76	.71	.69	29	.....	.71	.71	.....
15	.....	.76	.71	.69	30	0.78	.71	.71	.....
					31	.....	.74	.....	.....

Daily gage height, in feet, of Deep Creek near Townsend, Mont., for 1911.

[D. N. Maryott, observer.]

Day.	Mar.	Apr.	May.	June.	Day.	Mar.	Apr.	May.	June.
1	0.63	0.98	1.42	1.10	16	0.67	0.89	1.28	1.02
2	.63	1.04	1.46	1.10	17	.67	.96	1.30	1.02
3	.64	1.04	1.47	1.08	18	.69	1.04	1.30	1.00
4	.64	1.01	1.50	1.06	19	.70	1.08	1.27	1.00
5	.63	1.01	1.55	1.06	20	.70	1.09	1.24	.98
6	.63	.96	1.55	1.08	21	.70	1.13	1.26	.96
7	.63	.90	1.50	1.08	22	.72	1.13	1.26	.96
8	.64	.88	1.50	1.06	23	.75	1.20	1.24	.94
9	.64	.88	1.46	1.04	24	.79	1.22	1.20	.96
10	.65	.86	1.38	1.04	25	.76	1.30	1.18	.96
11	.65	.85	1.28	1.04	26	.70	1.36	1.18	.94
12	.65	.85	1.28	1.02	27	.70	1.38	1.16	.94
13	.66	.84	1.28	.98	28	.74	1.36	1.14	.92
14	.66	.85	1.30	.98	29	.80	1.36	1.14	.92
15	.67	.86	1.28	.98	30	.86	1.39	1.11	.92
					31	.90	.....	1.11	.....

PRICKLY PEAR CREEK BASIN.

PRICKLY PEAR CREEK NEAR CLANCY, MONT.

Location.—On the private wagon bridge back of the ranch buildings on the Stafford ranch and just to the right of the Great Northern Railway, about 1 mile below Clancy and just below the mouth of Lump Gulch Creek. This station was established to take the place of the one previously maintained about a mile below. The same amount of water passes both stations.

Records available.—July 15, 1908, to June 30, 1909 (old site); July 12, 1910, to December 31, 1911 (present site).

Drainage area.—Not measured.

Gage.—Staff, nailed to bridge abutment, right bank, on downstream side.

Discharge measurements.—Made from the wagon bridge or by wading.

Winter flow.—Ice is common in extreme cold weather.

Diversions.—Irrigation is carried on to some extent along this stream, the greater number of diversions being made below the station.

Discharge measurements of Prickly Pear Creek near Clancy, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 1	B. E. Jones	2.56	162
July 20	do	1.58	34

Daily gage height, in feet, of Prickly Pear Creek near Clancy, Mont., for 1911.

[H. Y. Barrows, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.79	1.90	2.60	2.38	1.43	1.38	1.59	1.53
2	.....	1.80	1.95	3.00	2.10	1.42	1.39	1.60	1.52
3	.....	1.62	1.96	2.98	2.08	1.44	1.48	1.58	1.52
4	.....	1.64	2.00	3.18	2.16	1.52	1.50	1.56	1.50
5	.....	1.55	2.15	3.13	2.00	1.61	1.60	1.54	1.50
6	.....	1.50	2.35	2.93	1.96	1.70	1.68	1.54	1.50
7	.....	1.54	2.10	2.88	1.89	1.78	1.66	1.53	1.50
8	.....	1.52	2.10	3.18	1.85	1.75	1.64	1.52	1.50
9	.....	1.70	2.12	3.10	1.84	1.72	1.63	1.54	1.62
10	.....	1.74	2.10	3.00	1.83	1.68	1.61	1.82	.....
11	.....	1.71	2.03	2.86	1.81	1.71	1.63	1.79	.....
12	.....	1.60	2.01	2.83	1.80	1.69	1.58	1.64	.....
13	.....	1.56	1.99	2.80	1.76	1.62	1.59	1.62	.....
14	.....	1.54	2.02	2.76	1.68	1.60	1.55	1.69	.....
15	.....	1.50	2.12	2.68	1.70	1.54	1.54	1.67	.....
16	.....	1.63	2.32	2.60	1.78	1.52	1.51	1.61	.....
17	.....	1.70	2.25	2.48	1.61	1.51	1.50	1.60	.....
18	1.60	1.70	2.18	2.36	1.58	1.48	1.50	1.60	.....
19	1.70	1.72	2.10	2.40	1.45	1.42	1.50	1.60	.....
20	1.81	1.70	2.08	2.48	1.48	1.41	1.48	1.58	.....
21	1.83	1.80	2.05	2.41	1.70	1.39	1.48	1.55	.....
22	1.72	1.91	2.08	2.33	1.63	1.40	1.48	1.54	.....
23	1.82	1.92	2.14	2.19	1.61	1.41	1.49	1.54	.....
24	1.80	1.85	2.16	2.23	1.58	1.39	1.50	1.53	.....
25	1.81	1.90	2.15	2.20	1.50	1.40	1.51	1.52	.....
26	1.82	2.00	2.18	2.18	1.52	1.40	1.54	1.52	.....
27	1.52	2.88	2.12	2.08	1.54	1.40	1.51	1.54	.....
28	1.69	2.40	2.16	2.18	1.48	1.39	1.47	1.53	.....
29	1.73	1.94	2.25	2.16	1.41	1.40	1.53	1.53	.....
30	1.72	1.91	2.30	2.18	1.42	1.40	1.55	1.54	.....
31	1.72	.....	2.54	.....	1.45	1.40	.....	1.54	.....

Daily discharge, in second-feet, of Prickly Pear Creek near Clancy, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	40	52	170	151	23	20	34	29
2	.....	41	58	259	91	22	20	35	29
3	.....	25	59	231	88	23	26	33	29
4	.....	26	64	300	102	29	27	32	27
5	.....	20	86	289	84	36	35	30	27
6	.....	17	120	256	77	45	43	30	27
7	.....	19	78	242	72	55	41	29	27
8	.....	25	78	310	62	52	39	29	27
9	.....	31	81	292	61	48	38	30	37
10	.....	35	78	272	60	43	36	61	.....
11	.....	32	68	260	57	46	38	57	.....
12	.....	23	65	231	56	44	33	39	.....
13	.....	21	63	224	51	37	34	37	.....
14	.....	19	67	213	42	35	31	44	.....
15	.....	17	81	196	44	30	30	42	.....
16	.....	25	115	188	55	29	28	36	.....
17	.....	31	102	162	36	28	27	35	.....
18	23	31	91	139	33	26	27	35	.....
19	31	33	78	147	24	22	27	35	.....
20	42	31	75	162	26	22	26	33	.....
21	44	41	71	149	45	20	26	31	.....
22	33	53	75	132	38	21	26	30	.....
23	43	54	84	107	36	22	26	30	.....
24	41	46	88	114	33	20	27	29	.....
25	42	52	86	110	27	21	28	29	.....
26	43	64	91	105	29	21	30	29	.....
27	18	232	81	88	30	21	28	30	.....
28	30	130	88	105	26	20	25	29	.....
29	34	57	102	101	22	21	29	29	.....
30	33	53	111	105	22	21	31	30	.....
31	33	.....	158	.....	24	21	.....	30	.....

NOTE.—Daily discharge determined from rating curves as follows: Mar. 18 to May 31, well defined; indirect method for shifting channels used June 1 to July 20; July 21 to Nov. 8, curve poorly defined.

Monthly discharge of Prickly Pear Creek near Clancy, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 30	1,840	D.
February	.....	.....	[a] 25	1,390	D.
March	.....	.....	29.5	1,810	C.
April	232	17	43.9	2,610	B.
May	158	52	83.7	5,150	B.
June	310	88	189	11,200	C.
July	151	22	51.7	3,180	C.
August	55	20	29.8	1,830	C.
September	43	20	30.1	1,790	C.
October	61	29	34.3	2,110	C.
November	.....	.....	22.6	1,340	C.
December	.....	.....	[a] 20	1,230	D.
The year	.....	.....	49.7	35,500	

[a] Estimated.

NOTE.—Discharge Mar. 1 to 17 estimated at 25 second-feet and Nov. 10 to 30 estimated at 20 second-feet.

PRICKLY PEAR CREEK AT EAST HELENA, MONT.

Location.—In NE. ¼ sec. 36, T. 10 N., R. 3 E., at the point where the Northern Pacific Railway crosses the stream at East Helena, Mont. The only important tributaries entering Prickly Pear Creek above the station are McClellan and Lump Gulch creeks; Tenmile and Silver creeks come in below.

Records available.—July 18, 1908, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff fastened to piling on the Northern Pacific Railway bridge; datum unchanged.

Channel.—Rocky, clean, and nonshifting.

Discharge measurements.—Made from a highway bridge near the railway bridge or by wading just below the gage.

Diversions.—All the normal flow of Prickly Pear Creek is used for irrigation, the greater part of the water being diverted below the station.

Accuracy.—The bed of the stream is so extremely rough that discharge measurements are difficult, even in low water. Fair results have, however, been obtained.

Discharge measurements of Prickly Pear Creek at East Helena, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 26[a]	B. E. Jones	0.99	35	Apr. 26	B. E. Jones	1.03	36
Feb. 14	do	0.93	31	26	do	1.04	36
Mar. 7	do	1.10	48	July 18	do	1.12	50
20	do	1.15	60	Sept. 26	R. Richards	0.95	33
30	do	1.08	50	Oct. 24	B. E. Jones	1.06	42

[a] Ice at gage.

Daily gage height, in feet, of Prickly Pear Creek at East Helena, Mont., for 1911.

[R. T. Ray, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.1	1.0	1.6	1.5	1.05	0.9	0.9	0.95
2	.....	1.1	.95	1.9	1.4	1.1	.9	.9	.95
3	.....	1.0	.95	1.9	1.35	1.05	.9	.9	.95
4	.....	1.0	1.0	1.95	1.35	1.05	.9	.9	.95
5	.....	1.0	1.1	2.0	1.3	1.1	1.0	.9	.9
6	.....	.85	1.3	1.85	1.25	1.1	1.0	.95	.9
7	.....	.85	1.2	2.0	1.2	1.1	.95	.95	.9
8	.....	1.0	1.15	2.0	1.15	1.0	.95	.95	.9
9	.....	1.05	1.15	1.95	1.15	1.05	.95	.95	.....
10	.....	1.05	1.1	1.9	1.15	1.05	.95	.95	.....
11	.....	1.05	1.15	1.85	1.15	1.0	.9	1.2	.....
12	.....	.9	1.15	1.8	1.15	1.0	.9	1.2	.....
13	.....	1.0	1.15	1.8	1.15	1.0	.95	1.1	.....
14	.....	1.0	1.15	1.85	1.1	1.0	.95	1.1	.....
15	.....	.95	1.3	1.8	1.1	1.0	.95	1.1	.....
16	.....	1.0	1.35	1.7	1.1	1.0	.95	1.1	.....
17	.....	1.0	1.35	1.65	1.1	.95	.95	1.05	.....
18	.....	1.0	1.3	1.7	1.1	.95	.95	1.05	.....
19	.....	1.0	1.2	1.7	1.1	.95	.95	1.05	.....
20	.....	.95	1.25	1.65	1.1	.95	.9	1.05	.....
21	.....	1.0	1.25	1.55	1.1	.95	.9	1.05	.....
22	1.50	1.05	1.15	1.5	1.1	.95	.9	1.05	.....
23	1.40	1.1	1.2	1.5	1.1	.95	.95	1.05	.....
24	1.20	1.05	1.3	1.45	1.1	.95	.95	1.05	.....
25	1.00	1.0	1.3	1.4	1.1	.95	.95	1.05	.....
26	1.10	.95	1.35	1.4	1.1	.95	.95	1.0	.....
27	1.10	1.3	1.4	1.35	1.05	.95	.95	.95	.....
28	1.10	1.1	1.4	1.35	1.05	.95	.9	.95	.....
29	1.10	1.0	1.35	1.35	1.0	.9	.9	.95	.....
30	1.10	.95	1.4	1.45	.95	.9	.9	.95	.....
31	1.10	.....	1.5	.....	.95	.9	.....	.95	.....

Daily discharge, in second-feet, of Prickly Pear Creek at East Helena, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	32	51	37	168	140	44	26	26	32
2	34	51	32	257	112	51	26	26	32
3	36	37	32	257	100	44	26	26	32
4	38	37	37	272	100	44	26	26	32
5	41	37	51	288	88	51	37	26	26
6	45	23	88	242	78	51	37	32	26
7	48	23	68	288	68	51	32	32	26
8	49	37	60	288	60	37	32	32	26
9	50	44	60	272	60	44	32	32	.....
10	51	44	51	257	60	44	32	32	.....
11	52	44	60	242	60	37	26	68	.....
12	53	26	60	227	60	37	26	68	.....
13	54	37	60	227	60	37	32	51	.....
14	55	37	60	242	51	37	32	51	.....
15	56	32	88	227	51	37	32	51	.....
16	57	37	100	197	51	37	32	51	.....
17	58	37	100	182	51	32	32	44	.....
18	59	37	88	197	51	32	32	44	.....
19	60	37	68	197	51	32	32	44	.....
20	60	32	78	182	51	32	26	44	.....
21	100	37	78	154	51	32	26	44	.....
22	140	44	60	140	51	32	26	44	.....
23	112	51	68	140	51	32	32	44	.....
24	68	44	88	126	51	32	32	44	.....
25	37	37	88	112	51	32	32	44	.....
26	51	32	100	112	51	32	32	37	.....
27	51	88	112	100	44	32	32	32	.....
28	51	51	112	100	44	32	26	32	.....
29	51	37	100	100	37	26	26	32	.....
30	51	32	112	126	32	26	26	32	.....
31	51	.....	140	.....	32	26	.....	32	.....

NOTE.—Daily discharge determined from a rating curve well defined below 90 second-feet.

Monthly discharge of Prickly Pear River near East Helena, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 35	2,150	D.
February	.....	.....	[a] 31	1,720	D.
March	140	32	56.5	3,470	C.
April	88	23	39.8	2,370	A.
May	140	32	75.4	4,640	A.
June	288	100	197	11,700	B.
July	140	32	61.2	3,760	A.
August	51	26	36.9	2,270	A.
September	37	26	29.9	1,780	A.
October	68	26	39.5	2,430	A.
November	.....	.....	26.1	1,550	C.
December	.....	.....	[a] 25	1,540	D.
The year	288	.....	54.4	39,400	

[a] Estimated.

NOTE.—Discharge Mar. 1 to 21 estimated; Nov. 9 to 30 estimated as 25 second-feet per day.

LUMP GULCH CREEK NEAR CLANCY, MONT.

Location.—In sec. 4, T. 8 N., R. 3 W., at the ranch of Charles Zastron, 1 mile from Clancy, 15 miles from Helena, and half a mile above the junction of the creek with Prickly Pear Creek.

Records available.—July 15, 1908, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff; on left bank directly south of observer's house. A new gage was set October 12, 1910, at the original site but at a datum 1.0 foot lower than that previously used. All gage heights for 1910 were reduced to new datum.

Channel.—Gravelly, unclean, and shifting.

Discharge measurements.—Made by wading.

Winter flow.—Affected by ice.

Diversions.—The water of Lump Gulch Creek has been extensively used for placer mining. At present the creek furnishes some water for irrigation, but the valley is narrow and affords but little irrigable land. The normal flow of the stream is appropriated.

Accuracy.—Data not entirely satisfactory; no flood records have been obtained.

Discharge measurements of Lump Gulch Creek near Clancy, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 1	B. E. Jones	1.47	23
July 20	do	1.12	3

Daily gage height, in feet, of Lump Gulch Creek near Clancy, Mont., for 1911.

[Charles Zastron, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.45	1.5	1.45	1.45	1.0	1.1	1.2	1.2
2	.....	1.4	1.5	1.45	1.45	1.0	1.1	1.2	1.2
3	.....	1.4	1.5	1.45	1.45	1.1	1.1	1.2	1.2
4	.....	1.4	1.55	1.45	1.45	1.1	1.2	1.2	1.2
5	.....	1.45	1.6	1.6	1.4	1.15	1.2	1.2	1.2
6	.....	1.4	1.55	1.65	1.35	1.15	1.2	1.2	1.2
7	.....	1.45	1.45	1.85	1.35	1.15	1.2	1.2	1.2
8	.....	1.45	1.45	1.85	1.35	1.15	1.2	1.2	1.2
9	.....	1.45	1.45	1.95	1.3	1.15	1.2	1.2	.....
10	.....	1.5	1.5	2.0	1.25	1.15	1.2	1.2	.....
11	.....	1.4	1.45	1.95	1.25	1.15	1.2	1.2	.....
12	1.25	1.4	1.45	1.95	1.25	1.15	1.2	1.2	.....
13	1.25	1.35	1.45	1.85	1.25	1.1	1.2	1.2	.....
14	1.25	1.35	1.4	1.85	1.15	1.1	1.2	1.2	.....
15	1.3	1.4	1.45	1.8	1.2	1.1	1.2	1.2	.....
16	1.3	1.35	1.4	1.75	1.15	1.1	1.2	1.2	.....
17	1.35	1.35	1.4	1.65	1.15	1.1	1.2	1.2	.....
18	1.35	1.35	1.4	1.65	1.15	1.1	1.2	1.2	.....
19	1.4	1.4	1.4	1.55	1.15	1.1	1.2	1.2	.....
20	1.45	1.45	1.45	1.6	1.1	1.1	1.2	1.2	.....
21	1.4	1.4	1.35	1.55	1.1	1.1	1.2	1.2	.....
22	1.45	1.45	1.4	1.55	1.1	1.1	1.2	1.2	.....
23	1.45	1.45	1.4	1.45	1.1	1.1	1.2	1.2	.....
24	1.45	1.45	1.45	1.45	1.1	1.1	1.2	1.2	.....
25	1.5	1.5	1.5	1.5	1.1	1.1	1.2	1.2	.....
26	1.45	1.5	1.45	1.45	1.1	1.1	1.2	1.2	.....
27	1.45	1.5	1.45	1.45	1.1	1.1	1.2	1.2	.....
28	1.45	1.5	1.45	1.45	1.0	1.1	1.2	1.2	.....
29	1.45	1.5	1.45	1.45	1.0	1.1	1.2	1.2	.....
30	1.5	1.55	1.5	1.5	1.0	1.1	1.2	1.2	.....
31	1.45	.....	1.45	.....	1.0	1.1	.....	1.2	.....

Daily discharge, in second-feet, of Lump Gulch Creek near Clancy, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	22	25	22	16	0.8	2.6	5.0	5.0
2	.....	20	25	22	16	.8	2.6	5.0	5.0
3	.....	20	25	22	16	2.6	2.6	5.0	5.0
4	.....	20	28	22	16	2.6	5.0	5.0	5.0
5	.....	22	30	30	14	3.8	5.0	5.0	5.0
6	.....	20	28	32	12	3.8	5.0	5.0	5.0
7	.....	22	22	43	12	3.8	5.0	5.0	5.0
8	.....	22	22	43	12	3.8	5.0	5.0	5.0
9	.....	22	22	49	9	3.8	5.0	5.0	.....
10	.....	25	25	52	7	3.8	5.0	5.0	.....
11	.....	20	22	49	7	3.8	5.0	5.0	.....
12	13	20	22	49	7	3.8	5.0	5.0	.....
13	13	18	22	40	7	2.6	5.0	5.0	.....
14	13	18	20	40	3.8	2.6	5.0	5.0	.....
15	15	20	22	37	5.0	2.6	5.0	5.0	.....
16	15	18	20	34	3.8	2.6	5.0	5.0	.....
17	18	18	20	28	3.8	2.6	5.0	5.0	.....
18	18	18	20	28	3.8	2.6	5.0	5.0	.....
19	20	20	20	22	3.8	2.6	5.0	5.0	.....
20	22	22	22	25	2.6	2.6	5.0	5.0	.....
21	20	20	18	22	2.6	2.6	5.0	5.0	.....
22	22	22	20	22	2.6	2.6	5.0	5.0	.....
23	22	22	20	16	2.6	2.6	5.0	5.0	.....
24	22	22	22	16	2.6	2.6	5.0	5.0	.....
25	25	25	25	19	2.6	2.6	5.0	5.0	.....
26	22	25	22	16	2.6	2.6	5.0	5.0	.....
27	22	25	22	16	2.6	2.6	5.0	5.0	.....
28	22	25	22	16	.8	2.6	5.0	5.0	.....
29	22	25	22	16	.8	2.6	5.0	5.0	.....
30	25	28	25	19	.8	2.6	5.0	5.0	.....
31	22	.....	22	.....	.8	2.6	.....	5.0	.....

NOTE.—Daily discharge determined from two poorly defined rating curves.

Monthly discharge of Lump Gulch Creek near Clancy, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 3.00	184	
February	.....	.....	[a] 3.00	167	
March	25	.....	15.1	928	C.
April	28	18	21.5	1,280	C.
May	30	18	22.6	1,390	C.
June	52	16	28.9	1,720	C.
July	16	.8	6.42	395	C.
August	3.8	.8	2.79	172	C.
September	5.0	2.6	4.76	283	C.
October	5.0	5.0	5.00	307	C.
November	.....	.....	5.00	298	C.
December	.....	.....	[a] 3.50	215	
The year	.....	.....	10.1	7,340	

[a] Estimated.

NOTE.—Mar. 1 to 11 estimated as 7.0 second-feet per day; Nov. 9 to 30 estimated as 5.0 second-feet per day.

TENMILE CREEK NEAR HELENA, MONT.

Location.—In SW. ¼ S. E. ¼ sec. 22, T. 10 N., R. 4 W., opposite the Broadwater Hotel, near Helena, Mont.

Records available.—July 8, 1908, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff, on right bank; datum unchanged.

Channel.—Shifts somewhat during flood stages.

Discharge measurements.—Made by wading.

Winter flow.—Affected by ice.

Diversions.—Part of the water supply for the city of Helena is taken from Tenmile Creek above the station. Two irrigation ditches also take water from the creek above the gage. The entire low-water flow is appropriated and used before it reaches the mouth of the creek.

Accuracy.—At low and medium stages conditions favor accurate determination of discharge.

Discharge measurements of Tenmile Creek near Helena, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 26	B. E. Jones	1.66	5.4	Apr. 25	B. E. Jones	2.37	32
Feb. 14	do	1.76	7.1	May 1	do	2.40	37
Mar. 7	do	[a] 1.60	4.4	26	do	2.76	74
31	do	2.12	17.0	July 18	do	1.81	6.5
31	do	2.12	17.2	Sept. 27	R. Richards	1.71	5.4

[a] Ice conditions.

Daily gage height, in feet, of Tenmile Creek near Helena, Mont., for 1911.

[J. W. Jackson, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	2.2	2.45	3.5	3.3	1.45	1.35	1.7	2.3
2	2.25	2.45	3.7	3.0	1.45	1.35	1.75	2.3
3	2.15	2.45	3.8	2.85	1.7	1.35	1.95	2.2
4	2.1	2.55	3.85	2.8	1.75	1.45	1.8	2.2
5	2.05	2.8	3.8	2.75	1.85	1.4	1.8	2.25
6	2.05	3.2	3.6	2.65	1.8	1.45	1.8	2.3
7	2.1	3.0	3.65	2.6	1.95	1.45	1.75	2.3
8	2.05	2.9	3.65	2.5	1.6	1.55	1.8	2.3
9	2.15	2.95	3.6	2.45	1.65	1.7	1.8	.....
10	2.2	2.8	3.5	2.4	1.65	1.8	1.8	.....
11	2.15	2.8	3.4	2.3	1.6	1.8	2.15	.....
12	2.0	2.8	3.3	2.2	1.6	1.7	2.15	.....
13	2.0	2.8	3.2	2.1	1.55	1.7	2.15	.....
14	2.0	2.8	3.25	2.05	1.5	1.7	2.15	.....
15	2.0	3.0	3.05	1.9	1.5	1.65	2.15	.....
16	2.0	3.0	3.0	1.9	1.45	1.7	2.15	.....
17	2.15	3.05	2.9	1.85	1.45	1.7	2.25	.....
18	2.15	3.0	2.7	1.9	1.4	1.7	2.2	.....
19	2.2	2.9	2.6	1.85	1.4	1.7	2.1	.....
20	2.2	2.75	2.7	1.8	1.4	1.7	2.1	.....
21	2.3	2.7	2.85	1.75	1.4	1.7	2.1	.....
22	2.4	2.65	2.7	1.75	1.4	1.7	2.1	.....
23	2.35	2.7	2.6	1.65	1.35	1.7	2.0	.....
24	2.3	2.9	2.8	1.55	1.4	1.7	2.0	.....
25	2.4	2.9	2.6	1.5	1.35	1.75	2.0	.....
26	2.6	2.8	2.55	1.65	1.35	1.75	1.9	.....
27	2.8	2.8	2.5	1.7	1.4	1.75	2.0	.....
28	2.65	2.8	2.55	1.65	1.4	1.7	2.3	.....
29	2.6	2.85	2.5	1.6	1.35	1.7	2.35	.....
30	2.5	2.9	2.6	1.55	1.35	1.7	2.4	.....
31	.....	3.2	.....	1.6	1.35	.....	2.3	.....

Daily discharge, in second-feet, of Tenmile Creek near Helena, Mont., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	22	42	178	148	1.2	.6	4.3	29
2	26	42	208	104	1.2	.6	5.4	29
3	20	42	223	85	4.3	.6	10	22
4	17	51	230	79	5.4	1.2	6.4	22
5	14	79	223	73	7.7	.8	6.4	26
6	14	133	193	62	6.4	1.2	6.4	29
7	17	104	200	56	10	1.2	5.4	29
8	14	91	200	46	2.7	2.1	6.4	29
9	20	98	193	42	3.5	4.3	6.4	.....
10	22	79	178	37	3.5	6.4	6.4	.....
11	20	79	163	29	2.7	6.4	20	.....
12	12	79	148	22	2.7	4.3	20	.....
13	12	79	133	17	2.1	4.3	20	.....
14	12	79	140	14	1.5	4.3	20	.....
15	12	104	111	9.0	1.5	3.5	20	.....
16	12	104	104	9.0	1.2	4.3	20	.....
17	20	111	91	7.7	1.2	4.3	26	.....
18	20	104	67	9.0	.8	4.3	22	.....
19	22	91	56	7.7	.8	4.3	17	.....
20	22	73	67	6.4	.8	4.3	17	.....
21	29	67	85	5.4	.8	4.3	17	.....
22	37	62	67	5.4	.8	4.3	17	.....
23	33	67	56	3.5	.6	4.3	12	.....
24	29	91	79	2.1	.8	4.3	12	.....
25	37	91	56	1.5	.6	5.4	12	.....
26	56	79	51	3.5	6	5.4	9.0	.....
27	79	79	46	4.3	.8	5.4	12	.....
28	62	79	51	3.5	.8	4.3	29	.....
29	56	85	46	2.7	.6	4.3	33	.....
30	46	91	56	2.1	.6	4.3	37	.....
31	.....	133	.....	2.7	.6	.....	29	.....

NOTE.—Daily discharge determined from a fairly well-defined rating curve.

Monthly discharge of Tenmile Creek near Helena, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 5.0	307	D.
February	.....	.....	[a] 6.0	333	D.
March	.....	.....	[a] 11.0	676	D.
April	79	12	27.1	1,610	B.
May	133	42	83.5	5,130	C.
June	230	46	123	7,320	C.
July	148	1.5	29	1,780	B.
August	10	.6	2.22	136	B.
September	6.4	.6	3.65	217	B.
October	37	4.3	15.6	959	B.
November	.....	.....	[a] 15	893	D.
December	.....	.....	[a] 9	553	D.
The year	.....	.....	.....	19,900	

[a] Estimated.

SEVENMILE CREEK AT BIRDSEYE, MONT.

Location.—At Richard Tobin's ranch, one-fourth mile from Birdseye, Mont.

Records available.—March 27, 1909, to December 31, 1911. From July 16, 1908, to August 26, 1908, a station was maintained on this stream at Dr. Head's ranch, near Helena.

Drainage area.—Not measured.

Gage.—Staff.

Channel.—Sandy and shifting.

Discharge measurements.—Made by wading.

Winter flow.—Affected by ice.

Diversions.—Entire flow of creek is appropriated and used for irrigation.

Discharge measurements of Sevenmile Creek at Birdseye, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 7	B. E. Jones	(a)	5.9
21	do	2.34	8.5
July 18	do	2.17	3.2

[a] Three feet of snow at gage.

Daily gage height, in feet, of Sevenmile Creek at Birdseye, Mont., for 1911.

[R. Tobin, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.25	2.1	2.3	2.5	2.3	2.0	2.0	2.3
2	.....	2.2	2.1	2.3	2.5	2.3	2.0	2.1	2.3
3	.....	2.2	2.0	2.3	2.45	2.3	2.0	2.05	2.35
4	.....	2.2	2.0	2.35	2.4	2.2	2.0	2.0	2.4
5	.....	2.15	1.95	2.45	2.25	2.15	1.95	1.95	2.35
6	.....	2.2	2.0	2.5	2.3	2.2	2.0	2.0	.....
7	.....	2.2	2.0	2.5	2.3	2.2	2.0	2.0	.....
8	.....	2.2	2.0	2.5	2.3	2.2	2.0	2.0	.....
9	.....	2.2	2.3	2.5	2.3	2.2	2.0	2.0	.....
10	.....	2.15	2.25	2.45	2.25	2.15	1.85	2.0	.....
11	.....	2.2	2.3	2.4	2.3	2.2	1.95	2.1	.....
12	.....	2.2	2.3	2.4	2.3	2.2	2.0	2.3	.....
13	.....	2.2	2.3	2.35	2.3	2.2	2.0	2.3	.....
14	.....	2.2	2.3	2.3	2.25	2.2	2.1	2.3	.....
15	.....	2.15	2.25	2.25	2.2	2.15	2.05	2.1	.....
16	.....	2.2	2.4	2.3	2.2	2.2	2.1	2.0	.....
17	.....	2.15	2.4	2.3	2.2	2.1	2.0	2.0	.....
18	.....	2.1	2.35	2.3	2.35	2.1	2.0	2.0	.....
19	.....	2.1	2.35	2.4	2.2	2.1	2.0	2.0	.....
20	.....	2.05	2.3	2.4	2.15	2.05	1.95	1.95	.....
21	2.30	2.1	2.35	2.5	2.2	2.1	2.1	2.15	.....
22	2.20	2.1	2.35	2.6	2.2	2.05	2.1	2.1	.....
23	2.20	2.1	2.35	2.6	2.2	2.0	2.1	2.1	.....
24	2.20	2.1	2.35	2.6	2.2	2.0	2.05	2.1	.....
25	2.15	2.05	2.25	2.55	2.15	1.95	1.95	2.05	.....
26	2.30	2.1	2.3	2.6	2.2	2.0	2.0	2.2	.....
27	2.20	2.1	2.3	2.5	2.3	2.0	2.0	2.3	.....
28	2.20	2.1	2.3	2.5	2.3	2.0	2.0	2.3	.....
29	2.20	2.15	2.3	2.5	2.3	2.0	2.0	2.35	.....
30	2.15	2.05	2.25	2.45	2.25	1.95	1.95	2.3	.....
31	2.20	.....	2.3	.....	2.3	2.0	.....	2.3	.....

Daily discharge, in second-feet, of Sevenmile Creek at Birdseye, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	4.0	5.2	1.8	6.7	15	6.7	0.7	0.7	6.7
2	4.0	3.8	1.8	6.7	15	6.7	.7	1.8	6.7
3	4.0	3.8	.7	6.7	13	6.7	.7	1.2	8.6
4	5.0	3.8	.7	8.6	10	3.8	.7	.7	10
5	5.0	2.8	.4	13	5.2	2.8	.4	.4	8.6
6	5.0	3.8	.7	15	6.7	3.8	.7	.7	.....
7	5.9	3.8	.7	15	6.7	3.8	.7	.7	.....
8	6.0	3.8	.7	15	6.7	3.8	.7	.7	.....
9	6.0	3.8	6.7	15	6.7	3.8	.7	.7	.....
10	6.0	2.8	5.2	13	5.2	2.8	.1	.7	.....
11	6.0	3.8	6.7	10	6.7	3.8	.4	1.8	.....
12	6.0	3.8	6.7	10	6.7	3.8	.7	6.7	.....
13	6.0	3.8	6.7	8.6	6.7	3.8	.7	6.7	.....
14	6.5	3.8	6.7	6.7	5.2	3.8	1.8	6.7	.....
15	6.5	2.8	5.2	5.2	3.8	2.8	1.2	1.8	.....
16	6.5	3.8	10	6.7	3.8	3.8	1.8	.7	.....
17	6.5	2.8	10	6.7	3.8	1.8	.7	.7	.....
18	6.5	1.8	8.6	6.7	8.6	1.8	.7	.7	.....
19	6.5	1.8	8.6	10	3.8	1.8	.7	.7	.....
20	6.5	1.2	6.7	10	2.8	1.2	.4	.4	.....
21	6.7	1.8	8.6	15	3.8	1.8	1.8	2.8	.....
22	3.8	1.8	8.6	20	3.8	1.2	1.8	1.8	.....
23	3.8	1.8	8.6	20	3.8	.7	1.8	1.8	.....
24	3.8	1.8	8.6	20	3.8	.7	1.2	1.8	.....
25	2.8	1.2	5.2	18	2.8	.4	.4	1.2	.....
26	6.7	1.8	6.7	20	3.8	.7	.7	3.8	.....
27	3.8	1.8	6.7	15	6.7	.7	.7	6.7	.....
28	3.8	1.8	6.7	15	6.7	.7	.7	6.7	.....
29	3.8	2.8	6.7	15	6.7	.7	.7	8.6	.....
30	2.8	1.2	5.2	13	5.2	.4	.4	6.7	.....
31	3.8	.....	6.7	.....	6.7	.7	.....	6.7	.....

NOTE.—Daily discharge determined from a rating curve that is poorly defined. Discharge estimated Mar. 1 to 6 and 8 to 20.

Monthly discharge of Sevenmile Creek at Birdseye, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 3.0	184	
February	.....	.....	[a] 3.0	167	
March	6.7	2.8	5.16	317	D.
April	5.2	1.2	2.82	168	C.
May	10	.4	5.60	344	C.
June	20	5.2	12.2	726	C.
July	15	2.8	6.32	389	C.
August	6.7	.4	2.64	162	C.
September	1.8	.4	.85	51	C.
October	8.6	.4	2.70	166	C.
November	.....	.....	[a] 5.0	298	
December	.....	.....	[a] 3.0	184	
The year	20	.....	4.36	3,160	

[a] Estimated.

LITTLE PRICKLY PEAR CREEK BASIN.

LITTLE PRICKLY PEAR CREEK NEAR MARYSVILLE, MONT.

Location.—In NW. ¼ NW. ¼ sec. 24, T. 12 N., R. 7 W., at the Pearce ranch, 6 miles west and 3 miles north of Marysville, Mont.

Records available.—May 18, 1909, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff; datum unchanged.

Channel.—Shifts in high water.

Discharge measurements.—Made by wading.

Winter flow.—Affected by ice.

Diversions.—Many small ditches take water from the stream, practically the entire flow being appropriated.

Discharge measurements of Little Prickly Pear Creek near Marysville, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 18	C. S. Heidel	3.02	22
July 20	do	2.74	11

Daily gage height, in feet, of Little Prickly Pear Creek near Marysville, Mont., for 1911.

[Gertrude P. Johnson, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.36	2.62	3.10	2.93	2.70	2.49	2.55	2.58
2	.....	2.36	2.65	3.15	2.93	2.70	2.49	2.55	2.58
3	.....	2.36	2.67	3.15	2.93	2.70	2.55	2.55	2.58
4	.....	2.36	2.68	3.20	2.91	2.70	2.55	2.55	2.58
5	.....	2.36	2.68	3.23	2.91	2.70	2.55	2.55	2.58
6	.....	2.36	3.00	3.25	2.90	2.70	2.62	2.55	2.57
7	.....	2.36	3.02	3.22	2.90	2.68	2.62	2.55	2.57
8	2.28	2.36	2.98	3.20	2.90	2.68	2.62	2.55	2.56
9	2.28	2.38	2.95	3.20	2.90	2.67	2.62	2.55	2.55
10	2.28	2.38	2.90	3.20	2.90	2.65	2.62	2.55	2.55
11	2.28	2.40	2.85	3.15	2.88	2.65	2.60	2.55	2.55
12	2.28	2.40	2.82	3.13	2.85	2.65	2.60	2.55	.....
13	2.28	2.43	2.82	3.08	2.82	2.65	2.58	2.55	.....
14	2.29	2.43	2.91	3.05	2.80	2.65	2.58	2.55	.....
15	2.30	2.44	2.95	3.00	2.80	2.63	2.58	2.55	.....
16	2.30	2.44	2.98	3.00	2.80	2.63	2.58	2.55	.....
17	2.31	2.44	3.00	3.00	2.80	2.58	2.58	2.60	.....
18	2.31	2.44	3.00	3.00	2.80	2.58	2.57	2.60	.....
19	2.31	2.45	2.95	3.00	2.80	2.58	2.57	2.60	.....
20	2.32	2.45	2.90	3.00	2.72	2.58	2.56	2.60	.....
21	2.32	2.46	2.90	2.95	2.72	2.58	2.56	2.60	.....
22	2.34	2.46	2.85	2.95	2.72	2.58	2.56	2.60	.....
23	2.35	2.47	2.85	3.00	2.72	2.58	2.56	2.60	.....
24	2.35	2.47	2.85	3.05	2.72	2.56	2.56	2.60	.....
25	2.35	2.49	2.88	3.00	2.72	2.55	2.56	2.60	.....
26	2.35	2.49	2.88	2.98	2.72	2.55	2.56	2.60	.....
27	2.35	2.49	2.90	2.98	2.72	2.55	2.55	2.59	.....
28	2.36	2.51	2.95	2.95	2.70	2.55	2.55	2.58	.....
29	2.36	2.52	3.00	2.93	2.70	2.55	2.55	2.58	.....
30	2.36	2.60	3.05	2.93	2.70	2.49	2.55	2.58	.....
31	2.36	.....	3.05	.....	2.70	2.49	.....	2.58	.....

Daily discharge, in second-feet, of Little Prickly Pear Creek near Marysville, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.5	2.4	8.0	25	18	10	4.8	6.2	6.9
2	1.5	2.4	8.8	27	18	10	4.8	6.2	6.9
3	1.4	2.4	9.4	27	18	10	6.2	6.2	6.9
4	1.4	2.4	9.7	28	17	10	6.2	6.2	6.9
5	1.3	2.4	9.7	30	17	10	6.2	6.2	6.9
6	1.3	2.4	21	30	17	10	8.0	6.2	6.7
7	1.2	2.4	21	29	17	9.7	8.0	6.2	6.7
8	1.2	2.4	20	28	17	9.7	8.0	6.2	6.4
9	1.2	2.7	19	28	17	9.4	8.0	6.2	6.2
10	1.2	2.7	17	28	17	8.8	8.0	6.2	6.2
11	1.2	3.0	15	27	16	8.8	7.4	6.2	6.2
12	1.2	3.0	14	26	15	8.8	7.4	6.2	.....
13	1.2	3.6	14	24	14	8.8	6.9	6.2	.....
14	1.4	3.6	17	23	14	8.8	6.9	6.2	.....
15	1.5	3.8	19	21	14	8.3	6.9	6.2	.....
16	1.5	3.8	20	21	14	8.3	6.9	6.2	.....
17	1.6	3.8	21	21	14	6.9	6.9	7.4	.....
18	1.6	3.8	21	21	14	6.9	6.7	7.4	.....
19	1.6	4.0	19	21	14	6.9	6.7	7.4	.....
20	1.8	4.0	17	21	11	6.9	6.4	7.4	.....
21	1.8	4.2	17	19	11	6.9	6.4	7.4	.....
22	2.1	4.2	15	19	11	6.9	6.4	7.4	.....
23	2.2	4.4	15	21	11	6.9	6.4	7.4	.....
24	2.2	4.4	15	23	11	6.4	6.4	7.4	.....
25	2.2	4.8	16	21	11	6.2	6.4	7.4	.....
26	2.2	4.8	16	20	11	6.2	6.4	7.4	.....
27	2.2	4.8	17	20	11	6.2	6.2	7.2	.....
28	2.4	5.2	19	19	10	6.2	6.2	6.9	.....
29	2.4	5.5	21	18	10	6.2	6.2	6.9	.....
30	2.4	7.4	23	18	10	4.8	6.2	6.9	.....
31	2.4	.....	23	.....	10	4.8	.....	6.9	.....

NOTE.—Daily discharge determined from a fairly well defined rating curve. Discharge estimated Mar. 1 to 7.

Monthly discharge of Little Prickly Pear Creek near Marysville, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 2.5	154	
February	.....	.....	[a] 1.5	83	
March	2.4	1.2	1.70	104	C.
April	7.4	2.4	3.69	220	B.
May	23	8.0	16.7	1,030	B.
June	30	18	23.5	1,400	B.
July	18	10	13.9	855	B.
August	10	4.8	7.89	485	B.
September	8.0	4.8	6.68	397	B.
October	7.4	6.2	6.71	413	B.
November	.....	.....	[a] 5.5	327	D.
December	.....	.....	[a] 5.0	307	
The year	.....	.....	7.94	5,780	

[a] Estimated.

LITTLE PRICKLY PEAR CREEK NEAR CANYON CREEK, MONT.

Location.—Near Canyon Creek post office, Mont. Principal tributaries above the station are Canyon, Marsh, Lost Horse, and Deadman creeks.

Records available.—April 1, 1909, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff; datum unchanged.

Channel.—Permanent at ordinary stages; will shift at flood stages.

Discharge measurements.—Made by wading.

Winter flow.—Affected by ice.

Diversions.—Many small ditches take water from this stream and the low-water flow is practically all appropriated.

Discharge measurements of Little Prickly Pear Creek near Canyon Creek, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 18	C. S. Heidel	2.85	90
July 20	do	1.72	1.8

Daily gage height, in feet, of Little Prickly Pear Creek near Canyon Creek, Mont., for 1911.

[W. J. Carbis, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	2.4	2.7	3.1	1.9	1.7	2.1
2	.....	2.5	2.65	3.0	1.9	1.7	2.1
3	.....	2.4	2.65	3.0	1.8	1.7	2.1
4	.....	2.4	2.6	2.9	1.9	1.7	2.2
5	.....	2.5	2.65	2.9	1.9	1.7	2.2
6	.....	2.5	2.65	2.9	1.8	1.8	2.25
7	2.2	2.45	2.75	3.0	1.8	1.85	2.25
8	2.1	2.45	2.75	3.0	1.8	1.9	2.3
9	2.1	2.4	2.65	2.9	1.9	1.9	2.3
10	2.1	2.4	2.7	2.8	1.9	1.9	2.3
11	2.1	2.34	2.75	2.8	1.8	1.9	2.3
12	2.1	2.34	2.75	2.7	1.8	1.9	2.3
13	2.2	2.34	2.75	2.6	1.8	1.9	2.2
14	2.25	2.35	2.75	2.6	1.8	2.0	2.2
15	2.3	2.35	2.8	2.4	1.8	2.1	2.3
16	2.35	2.35	2.8	2.4	1.8	2.1	2.4
17	2.4	2.35	2.8	2.4	1.8	2.1	2.4
18	2.3	2.4	2.8	2.3	1.8	2.0	2.4
19	2.3	2.4	2.8	2.3	1.7	2.0	2.4
20	2.3	2.4	2.9	2.3	1.7	2.0	2.5
21	2.3	2.5	2.9	2.2	1.7	1.9	2.5
22	2.4	2.65	2.8	2.2	1.6	1.9	2.4
23	2.5	2.65	2.8	2.2	1.6	1.8	2.4
24	2.5	2.7	2.85	2.15	1.6	1.8	2.3
25	2.4	2.7	2.8	2.15	1.6	1.7	2.3
26	2.3	2.75	2.85	2.1	1.6	1.8	2.3
27	2.35	2.65	2.9	2.1	1.6	1.8	2.3
28	2.4	2.65	2.9	2.1	1.7	1.9	2.2
29	2.4	2.65	3.0	2.15	1.6	2.0	2.2
30	2.5	2.7	3.0	2.2	1.6	2.0	2.2
31	2.5	.....	3.0	.....	1.6	2.0	.....

Daily discharge, in second-feet, of Little Prickly Pear Creek near Canyon Creek, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	15	35	67	129	5.0	1.5	13
2	15	44	61	111	5.0	1.5	13
3	16	35	61	111	3.0	1.5	13
4	16	35	55	95	5.0	1.5	20
5	17	44	61	95	5.0	1.5	20
6	17	44	61	95	3.0	3.0	24
7	20	40	74	111	3.0	4.0	24
8	13	40	74	111	3.0	5.0	27
9	13	35	61	95	5.0	5.0	27
10	13	35	67	81	5.0	5.0	27
11	13	30	74	81	3.0	5.0	27
12	13	30	74	67	3.0	5.0	27
13	20	30	74	55	3.0	5.0	20
14	24	31	74	55	3.0	8.0	20
15	27	31	81	35	3.0	13	27
16	31	31	81	35	3.0	13	35
17	35	31	81	35	3.0	13	35
18	27	35	81	27	3.0	8.0	35
19	27	35	81	27	1.5	8.0	35
20	27	35	95	27	1.5	8.0	44
21	27	44	95	20	1.5	5.0	44
22	35	61	81	20	0	5.0	35
23	44	61	81	20	0	3.0	35
24	44	67	88	16	0	3.0	27
25	35	67	81	16	0	1.5	27
26	27	74	88	13	0	3.0	27
27	31	61	95	13	0	3.0	27
28	35	61	95	13	1.5	5.0	20
29	35	61	111	16	0	8.0	20
30	44	67	111	20	0	8.0	20
31	44	.....	111	.....	0	8.0	.....

NOTE.—Daily discharge determined from a fairly well-defined rating curve. Discharge estimated Mar. 1 to 6.

Monthly discharge of Little Prickly Pear Creek near Canyon Creek, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 18	1,110	D.
February	.....	.....	[a] 15	833	D.
March	44	13	25.8	1,590	B.
April	74	30	44.3	2,640	B.
May	111	55	79.8	4,910	B.
June	129	13	54.8	3,260	B.
July	5.0	.0	2.32	143	B.
August	13	1.5	5.42	333	B.
September	44	13	26.5	1,580	B.
October	.....	.....	[a] 20	1,230	D.
November	.....	.....	[a] 15	893	D.
December	.....	.....	[a] 12	738	D.
The year	.....	.....	26.6	19,300	

[a] Estimated.

DEADMAN CREEK NEAR MARYSVILLE, MONT.

Location.—Near the ranch of Charles Johnson, half a mile above the junction of Deadman Creek with Lost Horse Creek, and 6 miles from Marysville, Mont.

Records available.—April 2, 1909, to June 30, 1911.

Drainage area.—Not measured.

Gage.—Staff. The staff gage was moved to a point 300 yards below the original site on June 8, 1909, and was established at a new datum.

Channel.—Probably permanent.

Discharge measurements.—Made by wading.

Winter flow.—Affected by ice.

Diversions.—One or two small ditches take water from the stream.

Discharge measurements of Deadman Creek near Marysville, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 18	C. S. Heidel	2.51	36.3
July 20	do	2.11	10.3

Daily gage height, in feet, and discharge, in second-feet, of Deadman Creek near Marysville, Mont., for 1911.

[Chas. Johnson, observer.]

Day.	March.		April.		May.		June.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	4.0	2.10	10	2.52	38	2.42	30
2	.....	4.0	2.10	10	2.52	38	2.45	32
3	.....	4.0	2.12	11	2.57	42	2.45	32
4	.....	4.0	2.12	11	2.60	45	2.45	32
5	.....	3.9	2.12	11	2.65	50	2.49	35
6	.....	3.9	2.12	11	2.67	52	2.52	38
7	.....	3.9	2.12	11	2.67	52	2.55	40
8	.....	3.8	2.10	10	2.67	52	2.54	40
9	.....	3.8	2.07	8.8	2.72	57	2.52	38
10	.....	3.8	2.10	10	2.72	57	2.52	38
11	.....	3.7	2.12	11	2.70	55	2.52	38
12	.....	3.7	2.07	8.8	2.67	52	2.52	38
13	1.92	3.6	2.07	8.8	2.67	52	2.52	38
14	1.92	3.6	2.07	8.8	2.64	49	2.51	37
15	1.97	5.1	2.07	8.8	2.62	47	2.50	36
16	1.97	5.1	2.12	11	2.61	46	2.50	36
17	2.00	6.0	2.12	11	2.55	40	2.50	36
18	2.00	6.0	2.14	12	2.50	36	2.50	36
19	2.07	8.8	2.17	14	2.49	35	2.50	36
20	2.05	8.0	2.17	14	2.48	34	2.48	34
21	2.10	10	2.22	16	2.48	34	2.45	32
22	2.10	10	2.22	16	2.48	34	2.45	32
23	2.10	10	2.27	19	2.46	33	2.45	32
24	2.07	8.8	2.27	19	2.46	33	2.42	30
25	2.07	8.8	2.31	22	2.45	32	2.42	30
26	2.10	10	2.35	24	2.45	32	2.44	31
27	2.07	8.8	2.40	28	2.45	32	2.45	32
28	2.05	8.0	2.42	30	2.45	32	2.45	32
29	2.05	8.0	2.47	34	2.45	32	2.45	32
30	2.10	10	2.47	34	2.42	30	2.45	32
31	2.10	10	.....	.....	2.42	30	.....	.....

NOTE.—Daily discharge determined from a poorly defined rating curve. Discharge Mar. 1 to 12 estimated.

Monthly discharge of Deadman Creek near Marysville, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 5.0	307	
February	.....	.....	[a] 4.0	222	
March	10	3.6	6.3	387	C.
April	34	8.8	15.1	898	C.
May	57	30	41.4	2,550	C.
June	40	30	34.5	2,050	C.
The period	.....	.....	17.9	6,410	

[a] Estimated.

LOST HORSE CREEK NEAR MARYSVILLE, MONT.

Location.—At the ranch of Charles Johnson, one-fourth mile above the junction of Lost Horse with Deadman Creek and about 6 miles from Marysville.

Records available.—April 2, 1909, to June 30, 1911.

Drainage area.—Not measured.

Gage.—Staff.

Channel.—Will shift at high stages.

Discharge measurements.—Made by wading.

Diversions.—One ditch takes water from Lost Horse Creek.

Accuracy.—Conditions favor accurate determinations of discharge at low and ordinary stages.

Discharge measurements of Lost Horse Creek near Marysville, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 18	C. S. Heidel	2.12	3.29
July 20	do	2.01	1.75

Daily gage height, in feet, and discharge, in second-feet, of Lost Horse Creek near Marysville, Mont., for 1911.

[Chas. Johnson, observer.]

Day.	April.		May.		June.		Day.	April.		May		June.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	0	2.00	1.8	2.15	3.4	16	1.58	0.08	2.10	2.8	2.12	3.0
2	.....	0	2.00	1.8	2.15	3.4	17	1.62	.12	2.12	3.0	2.12	3.0
3	.....	0	2.00	1.8	2.15	3.4	18	1.65	.15	2.12	3.0	2.12	3.0
4	.....	0	2.05	2.3	2.15	3.4	19	1.68	.18	2.12	3.0	2.12	3.0
5	.....	0	2.05	2.3	2.18	3.8	20	1.71	.23	2.15	3.4	2.12	3.0
6	.....	0	2.05	2.3	2.20	4.0	21	1.75	.35	2.15	3.4	2.10	2.8
7	.....	0	2.05	2.3	2.20	4.0	22	1.78	.4	2.15	3.4	2.10	2.8
8	.....	0	2.05	2.3	2.20	4.0	23	1.80	.5	2.15	3.4	2.10	2.8
9	1.50	0	2.06	2.4	2.18	3.8	24	1.81	.6	2.15	3.4	2.10	2.8
10	1.50	0	2.08	2.6	2.16	3.5	25	1.85	.8	2.18	3.8	2.10	2.8
11	1.50	0	2.08	2.6	2.15	3.4	26	1.85	.8	2.18	3.8	2.10	2.8
12	1.55	.05	2.10	2.8	2.15	3.4	27	1.90	1.0	2.18	3.8	2.11	2.9
13	1.55	.05	2.10	2.8	2.15	3.4	28	1.90	1.0	2.18	3.8	2.12	3.0
14	1.58	.08	2.10	2.8	2.12	3.0	29	1.98	1.6	2.16	3.5	2.12	3.0
15	1.58	.08	2.10	2.8	2.12	3.0	30	2.00	1.8	2.16	3.5	2.12	3.0
							31	.....	.....	2.16	3.5	.....	.....

NOTE.—Daily discharge determined from a poorly defined rating curve. Discharge Apr. 1 to 8 estimated.

Monthly discharge of Lost Horse Creek near Marysville, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
April	1.8	0	0.33	20	C.
May	3.8	1.8	2.91	179	C.
June	4.0	2.8	3.22	192	C.

NOTE.—Practically no flow January and February. Records discontinued June 30.

MARSH CREEK NEAR MARYSVILLE, MONT.

Location.—In the NE. ¼ SE. ¼ sec. 6, T. 12 N., R. 6 W., at the Hartmiller ranch, about 1 mile above the junction of Marsh Creek with Little Prickly Pear Creek.

Records available.—April 1, 1909, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff.

Channel.—Shifting.

Discharge measurements.—Made by wading near gage.

Winter flow.—Affected by ice.

Diversions.—The creek supplies no important ditches.

Discharge measurements of Marsh Creek near Marysville, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 18	C. S. Heidel	1.48	2.69
July 20	do	1.40	2.54

Daily gage height, in feet, of Marsh Creek near Marysville, Mont., for 1911.

[J. Hartmiller, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.44	1.40	1.45	1.46	1.36	1.25	.....	1.25
2	.....	1.45	1.40	1.45	1.45	1.45	1.25	1.35	1.30
3	.....	1.42	1.40	1.45	1.43	1.38	1.45	1.30	1.30
4	.....	1.42	1.45	1.47	1.41	1.44	1.35	1.30	1.30
5	.....	1.40	1.45	1.46	1.41	1.40	1.35	1.30	1.30
6	.....	1.40	1.45	1.47	1.40	1.45	1.35	1.30	1.30
7	.....	1.40	1.45	1.52	1.40	1.40	1.33	1.30	.....
8	.....	1.40	1.45	1.52	1.40	1.40	1.33	1.26	.....
9	.....	1.40	1.43	1.48	1.39	1.40	1.30	1.26	.....
10	.....	1.40	1.43	1.46	1.40	1.36	1.25	1.25	.....
11	.....	1.38	1.43	1.45	1.40	1.35	1.25	1.35	.....
12	.....	1.41	1.43	1.48	1.40	1.34	1.25	1.35	.....
13	.....	1.40	1.41	1.48	1.40	1.33	1.25	1.35	.....
14	.....	1.36	1.41	1.48	1.40	1.32	1.25	1.35	.....
15	.....	1.38	1.60	1.48	1.42	1.32	1.25	1.35	.....
16	.....	1.39	1.48	1.45	1.40	1.32	1.25	1.35	.....
17	.....	1.38	1.46	1.45	1.42	1.25	1.25	1.35	.....
18	1.36	1.39	1.46	1.40	1.44	1.25	1.25	1.35	.....
19	1.40	1.40	1.47	1.75	1.42	1.25	1.25	1.35	.....
20	1.44	1.40	1.46	1.55	1.40	1.26	1.25	1.30	.....
21	1.44	1.41	1.46	1.45	1.40	1.30	1.30	1.30	.....
22	1.45	1.40	1.45	1.42	1.40	1.30	1.30	1.30	.....
23	1.44	1.40	1.46	1.42	1.39	1.30	1.30	1.30	.....
24	1.45	1.39	1.48	1.50	1.39	1.25	1.30	1.25	.....
25	1.42	1.39	1.50	1.45	1.39	1.25	1.30	1.25	.....
26	1.38	1.39	1.50	1.45	1.38	1.25	1.30	1.25	.....
27	1.36	1.40	1.50	1.45	1.35	1.25	1.30	1.25	.....
28	1.39	1.42	1.50	1.44	1.35	1.25	1.30	1.25	.....
29	1.40	1.43	1.50	1.48	1.35	1.25	.....	1.25	.....
30	1.42	1.40	1.50	1.47	1.35	1.25	.....	1.25	.....
31	1.42	.....	1.45	.....	1.35	1.25	.....	1.25	.....

Daily discharge, in second-feet, of Marsh Creek near Marysville, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.3	2.4	2.0	2.4	3.0	2.2	1.6	2.0	1.6
2	1.3	2.4	2.0	2.4	2.9	2.9	1.6	2.1	1.8
3	1.3	2.2	2.0	2.4	2.7	2.3	2.9	1.8	1.8
4	1.3	2.2	2.4	2.6	2.5	2.8	2.1	1.8	1.8
5	1.4	2.0	2.4	2.5	2.5	2.4	2.1	1.8	1.8
6	1.4	2.0	2.4	2.6	2.4	2.9	2.1	1.8	1.8
7	1.4	2.0	2.4	3.2	2.4	2.4	2.0	1.8	.....
8	1.4	2.0	2.4	3.2	2.4	2.4	2.0	1.7	.....
9	1.5	2.0	2.3	2.7	2.3	2.4	1.8	1.7	.....
10	1.5	2.0	2.3	2.5	2.4	2.2	1.6	1.6	.....
11	1.5	1.9	2.3	2.4	2.4	2.1	1.6	2.1	.....
12	1.5	2.1	2.3	2.7	2.4	2.0	1.6	2.1	.....
13	1.6	2.0	2.1	2.7	2.4	2.0	1.6	2.1	.....
14	1.6	1.8	2.1	2.7	2.4	1.9	1.6	2.1	.....
15	1.6	1.9	4.4	2.7	2.6	1.9	1.6	2.1	.....
16	1.7	2.0	2.7	2.4	2.4	1.9	1.6	2.1	.....
17	1.7	1.9	2.5	2.4	2.6	1.6	1.6	2.1	.....
18	1.8	2.0	2.5	2.0	2.8	1.6	1.6	2.1	.....
19	2.0	2.0	2.6	8.4	2.6	1.6	1.6	2.1	.....
20	2.4	2.0	2.5	4.2	2.4	1.7	1.6	1.8	.....
21	2.4	2.1	2.5	2.9	2.4	1.8	1.8	1.8	.....
22	2.4	2.0	2.4	2.6	2.4	1.8	1.8	1.8	.....
23	2.4	2.0	2.5	2.6	2.3	1.8	1.8	1.8	.....
24	2.4	2.0	2.7	3.4	2.3	1.6	1.8	1.6	.....
25	2.2	2.0	2.9	2.9	2.3	1.6	1.8	1.6	.....
26	1.9	2.0	2.9	2.9	2.3	1.6	1.8	1.6	.....
27	1.8	2.0	2.9	2.9	2.1	1.6	1.8	1.6	.....
28	2.0	2.2	2.9	2.8	2.1	1.6	1.8	1.6	.....
29	2.0	2.3	2.9	3.2	2.1	1.6	1.9	1.6	.....
30	2.2	2.0	2.9	3.1	2.1	1.6	2.0	1.6	.....
31	2.2	.....	2.4	.....	2.1	1.6	.....	1.6	.....

NOTE.—Daily discharge determined from two poorly defined rating curves, as follows: Mar. 18 to June 18 and June 19 to Nov. 6. Discharge estimated Mar. 1 to 17 and Sept. 29 to Oct. 1.

Monthly discharge of Marsh Creek near Marysville, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 1.30	80	
February	.....	.....	[a] 1.30	72	
March	2.4	1.3	1.78	109	C.
April	2.4	1.8	2.05	122	C.
May	4.4	2.0	2.53	156	C.
June	8.4	2.0	2.95	176	C.
July	3.0	2.1	2.42	149	C.
August	2.9	1.6	1.98	122	C.
September	2.9	1.6	1.80	107	C.
October	2.1	1.6	1.84	113	C.
November	.....	.....	[a] 1.70	101	
December	.....	.....	[a] 1.50	92	
The year	.....	.....	1.93	1,400	

[a] Estimated.

DEARBORN RIVER BASIN.

DEARBORN RIVER NEAR CLEMONS, MONT.

Location.—2 miles above Clemons, Mont., half a mile above the headworks of the old Dearborn Canal, and half a mile above the mouth of Falls Creek.

Records available.—May 4, 1908, to December 31, 1911.

Drainage area.—110 square miles.

Gage.—Staff; not read every day as it is about 2 miles from observer's house. The datum of the gage was lowered 1 foot on October 21, 1910, and all gage heights for the year were consequently changed.

Channel.—Permanent.

Discharge measurements.—Made from cable just above gage or by wading.

Winter flow.—Stream freezes over and gage-height observations are discontinued.

Diversions.—None above the station.

Accuracy.—Interpolations between gage readings are believed to be fairly accurate.

Discharge measurements of Dearborn River near Clemons, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 17[a]	J. C. Beebe	.....	13.7	June 25	B. E. Jones	1.65	252
Mar. 21	do	0.93	38	July 28	R. Richards	1.09	78
May 21	B. E. Jones	1.68	252	Oct. 27	W. A. Lamb	.93	43
June 6	J. C. Beebe	2.08	508				

[a] Ice conditions. Discharge estimated from a measurement made below mouth of Falls Creek, wading.

Daily gage height, in feet, of Dearborn River near Clemons, Mont., for 1911.

[O. A. Kench, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	.....	.....	.....	1.49	.....	0.94	1.04
2	.....	1.10	1.42	1.97	1.44	1.09	.....	.....
3	.....	.....	.....	.....	.....	1.08	.97	1.14
4	.....	1.00	1.50	2.15	.....	1.13	.....	.....
5	.....	.....	.....	.....	1.39	.....	1.35	1.08
6	.....	.97	1.61	2.05	1.37	1.11	.....	.....
7	.....	.....	1.75	.....	.....	.....	1.38	1.07
8	.....	.97	.....	2.65	1.34	1.10	.....	1.06
9	.....	.96	1.69	2.15	1.30	1.10	1.39	.....
10	.....	.....	.....	2.10	.....	.....	1.38	1.06
11	.....	.....	1.60	2.10	1.30	1.09	.....	1.06
12	.....	1.04	.....	.....	.....	.....	1.37	.....
13	.....	.....	1.65	2.15	1.27	1.05	1.37	1.05
14	.....	1.00	.....	.....	1.22	.....	.....	.....
15	.....	.....	2.35	2.00	.....	1.03	1.28	1.05
16	.....	.99	.....	.....	1.20	.....	1.20	.....
17	.....	.....	2.05	1.88	.....	1.00	.....	.....
18	.....	1.05	.....	.....	1.19	.....	1.20	1.07
19	.....	1.11	2.00	1.80	.....	1.00	.....	.....
20	.....	.....	.....	.....	1.16	.99	1.20	1.03
21	0.93	1.16	1.68	1.76	1.19	.....	.....	.....
22	.....	.....	.....	.....	.....	.99	1.18	1.00
23	.90	1.30	1.64	1.75	1.16	.....	.....	.....
24	.....	.....	.....	1.72	.....	.97	1.17	1.00
25	.93	1.30	1.66	1.65	1.15	.....	.....	.99
26	.....	.....	.....	.....	1.12	.97	1.15	.....
27	.99	1.35	1.60	1.59	.....	.99	.....	1.05
28	.....	.....	.....	.....	1.09	.98	1.11	.....
29	.94	1.37	1.52	1.52	.....	.....	.....	.94
30	.....	1.34	.....	.....	1.09	.....	1.05	.....
31	.98	.....	1.82	.....	.....	.95	.....	.94

Daily discharge, in second-feet, of Dearborn River near Clemons, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	30	62	140	376	176	71	44	61
2	30	73	152	424	159	71	46	71
3	31	63	166	502	153	69	48	81
4	31	53	180	580	147	79	90	75
5	32	50	202	534	142	77	132	69
6	32	48	224	488	137	75	136	68
7	33	48	290	824	133	74	140	67
8	33	48	276	1,160	129	73	141	65
9	34	47	260	580	118	73	142	65
10	34	51	240	530	118	72	140	65
11	35	56	220	530	118	71	138	65
12	35	61	231	555	114	67	137	64
13	36	57	242	580	111	63	137	63
14	36	53	521	512	99	61	125	63
15	37	52	800	445	96	59	113	63
16	38	52	644	404	94	56	94	64
17	39	57	488	363	93	53	94	66
18	40	63	466	339	92	53	94	67
19	41	75	445	315	89	53	94	68
20	42	80	350	305	86	52	94	59
21	42	86	256	295	92	52	92	56
22	40	102	247	292	89	52	90	53
23	38	118	238	290	86	50	88	53
24	40	118	242	275	85	48	87	53
25	42	118	247	242	84	48	86	52
26	47	125	234	230	77	48	84	58
27	52	132	220	216	74	52	80	63
28	48	134	204	202	71	50	75	54
29	44	137	188	188	71	49	69	44
30	47	129	258	182	71	47	63	44
31	50	.....	327	.....	71	46	.....	44

NOTE.—Daily discharge determined from a fairly well-defined rating curve. Discharge Mar. 1 to 20 estimated. Discharge interpolated for days on which gage was not read.

Monthly discharge of Dearborn River near Clemons, Mont., for 1911.

[Drainage area 110 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a] 35	0.318	0.37	2,150	D.
February	.....	.....	[a] 30	.273	.28	1,670	D.
March	52	30	38.4	.349	.40	2,360	C.
April	137	48	78.3	.712	.79	4,660	B.
May	800	140	297	2.70	3.11	18,300	B.
June	1,160	182	425	3.86	4.31	25,300	B.
July	176	71	106	.964	1.11	6,520	B.
August	79	46	60.1	.546	.63	3,700	B.
September	142	44	99.8	.907	1.01	5,940	B.
October	81	44	61.4	.558	.64	3,780	B.
November	.....	.....	[a] 40	.364	.41	2,380	D.
December	.....	.....	[a] 35	.318	.37	2,150	D.
The year	1,160	.....	109	.991	13.43	78,900	

[a] Estimated.

FALLS CREEK NEAR CLEMONS, MONT.

Location.—At a point 1½ miles above Clemons, Mont., 500 feet above the mouth of the creek.

Records available.—May 4, 1908, to December 31, 1911; fragmentary because of the great distance the observer lives from the gage.

Drainage area.—Not measured.

Gage.—Staff; datum unchanged.

Channel.—Permanent except in flood.

Discharge measurements.—Made by wading or from a cable.

Winter flow.—Affected by ice.

Diversions.—The entire flow of this stream reaches Dearborn River.

Accuracy.—Interpolations between observed gage heights believed to be fairly accurate.

Falls Creek affords opportunities for water power development above the station, as its fall is large.

Discharge measurements of Falls Creek near Clemons, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 17	J. C. Beebe	(a)	b 11.3	June 25	B. E. Jones	1.50	101
Mar. 21	do	0.70	11.8	July 28	R. Richards	1.01	41
May 21	B. E. Jones	1.57	111	Oct. 27	W. A. Lamb	a 1.05	32
June 6	J. C. Beebe	2.04	226				

a Ice conditions.
b Discharge estimated from measurement made below junction with Dearborn River.

Daily gage height in feet of Falls Creek near Clemons, Mont., for 1911.

[O. A. Kench, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1					1.41		0.91	1.03
2		0.77	1.11	1.83	1.37	1.0		
3						1.0	.92	1.14
4		.77	1.15	2.12		1.04		
5					1.32		1.1	1.1
6		.77	1.29	1.96	1.29	1.04		
7			1.45				1.27	1.08
8		.78		2.25	1.23	1.05		1.08
9		.78	1.42	2.02	1.22	1.04	1.3	
10				2.02			1.32	1.08
11			1.39	2.0	1.21	1.02		1.08
12		.98					1.38	
13			1.41	2.18	1.19	.97	1.4	1.1
14		.97			1.17			
15			1.86	1.97		.97	1.32	1.07
16		.99			1.12		1.28	
17			1.8	1.75		.95		
18		.82			1.11		1.19	1.11
19		.83	1.77	1.68		.94		
20					1.09	.94	1.14	1.1
21	0.70	.87	1.57	1.65	1.17			
22						.93	1.15	1.1
23	.70	.93	1.50	1.63	1.12			
24				1.58		.93	1.15	1.1
25	.70	1.05	1.49	1.51	1.09			1.08
26					1.08	.92	1.11	
27	.72	1.10	1.49	1.49		.92		.93
28					1.01	.91	1.00	
29	.72	1.10	1.48	1.45				.93
30		1.11	1.7		1.00		1.05	.91
31	.74		1.7			.92		

Daily discharge, in second-feet, of Falls Creek near Clemons, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	15	42	156	85	40	31	43
2	.....	16	42	172	78	40	32	49
3	.....	16	44	209	75	40	32	55
4	.....	16	47	215	72	44	41	52
5	.....	16	56	225	70	44	50	50
6	.....	16	66	205	66	44	61	49
7	.....	16	92	245	62	44	72	48
8	.....	16	90	285	57	45	74	48
9	.....	16	87	220	56	44	76	48
10	.....	20	84	220	59	43	79	48
11	.....	24	81	215	63	42	85	48
12	.....	29	83	240	62	40	90	49
13	.....	29	85	264	61	37	93	50
14	.....	29	132	236	58	37	86	48
15	.....	30	180	208	55	37	79	47
16	.....	30	172	180	52	36	73	48
17	.....	24	165	152	52	35	67	50
18	.....	18	162	144	51	34	61	51
19	.....	19	158	136	50	34	58	51
20	.....	20	136	133	49	34	55	51
21	12	21	114	130	58	34	56	51
22	12	23	107	128	55	33	56	51
23	12	25	101	126	52	33	56	51
24	12	30	100	116	50	33	56	51
25	12	36	99	103	49	32	54	48
26	12	38	99	101	48	32	51	40
27	13	41	99	99	44	32	50	33
28	13	41	98	96	41	31	49	33
29	13	41	97	92	40	31	47	33
30	14	42	140	88	40	32	45	31
31	14	.....	140	.....	40	32	.....	31

NOTE.—Daily discharge determined from two fairly well-defined curves as follows: Mar. 21 to July 9 and July 11 to Oct. 31.

Monthly discharge of Falls Creek near Clemons, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 10	615	
February	.....	.....	[a] 10	555	
March	14	.....	10.9	670	C.
April	42	15	25.1	1,490	B.
May	180	42	103	6,330	B.
June	285	88	172	10,200	B.
July	85	40	56.5	3,470	C.
August	45	31	37.1	2,280	C.
September	93	31	60.5	3,600	C.
October	55	31	46.3	2,850	C.
November	.....	.....	[a] 25	1,490	
December	.....	.....	[a] 15	922	
The year	285	.....	47.7	34,500	

[a] Estimated. Discharge Mar. 1 to 20 estimated at 10 second-feet per day.

SUN RIVER BASIN.

NORTH FORK OF SUN RIVER NEAR AUGUSTA, MONT.

Location.—At the head of Kilraven ditch, near Christian's ranch, 12 miles northwest of Augusta, 21 miles southwest of Chouteau, Mont.

Records available.—October 31, 1903, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Chain, datum unchanged.

Channel.—Permanent.

Discharge measurements.—Made from cable.

Winter flow.—Affected by ice.

Diversions.—Water is diverted below the station for irrigation of the valley lands, but no water is diverted above the station.

Accuracy.—Conditions for accurate determination of discharge are excellent, except during the winter months.

Discharge measurements of North Fork of Sun River near Augusta, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 14	J. C. Beebe	[a] 1.83	242	June 8	J. C. Beebe	4.43	4,900
Mar. 23	do	1.04	447	24	B. E. Jones	3.35	2,670
May 19	B. E. Jones	3.43	2,870	July 27	R. Richards	1.41	652
19	do	3.39	2,780	Oct. 25	W. A. Lamb	0.94	351

[a] Ice present.

Daily gage height, in feet of North Fork of Sun River near Augusta, Mont., for 1911.

[Charles Dox, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.4			2.2	4.0	3.1	1.4		0.9	0.9	0.9
2	0.8			1.0		4.5	3.1		0.9	1.1	0.95	0.9
3		1.5			2.3	4.5	3.1	1.4	0.9	1.2	0.9	0.85
4	0.8	1.5		1.0			3.1			1.1	0.85	0.8
5					3.9		3.0	1.4	1.2	1.0	0.85	0.8
6	0.8	1.3	1.2			4.0	3.0	1.5		1.1	0.85	0.8
7				1.0	3.5		2.9		1.4	1.0	0.85	0.8
8	1.4	1.3	1.3			4.4	2.8	1.4		0.9	0.85	0.85
9				0.9	3.2		2.6		1.0	1.0	0.85	0.8
10	1.6	1.3				3.9	2.5	1.5	1.0	0.9	0.85	0.8
11			1.1		3.0		2.2			0.9	0.9	0.85
12	1.6	1.1		0.9			2.0	1.5	1.1	1.0	1.0	0.85
13	1.8		1.1			4.5		1.5		0.9	1.05	0.85
14							1.9		1.0	0.9	1.25	0.85
15	1.6	1.1	1.0	1.1		4.8	1.9	1.4		1.0	1.35	0.8
16					4.2		1.8		1.0	1.0	1.4	0.75
17		1.1	0.8	1.0	3.6	3.9		1.1	1.0	1.0	1.45	0.7
18	1.3				3.5		1.7			1.1	1.35	0.75
19		1.0	0.8	1.2				1.0	1.0	1.2	1.1	0.75
20	1.3				3.0	3.8	1.7			1.1	1.0	0.7
21			0.9	1.9				1.0	0.9	1.0	0.95	0.75
22	1.2				3.0	3.8	1.4		0.9	1.1	0.85	0.8
23			1.2	2.1				1.0		1.0	0.8	0.8
24	1.4			2.0	3.0	3.7	1.5		1.0	1.0	0.85	0.85
25			1.0	2.2			1.6	0.9		1.0	0.85	0.8
26	1.4				2.8	3.6			1.0	0.85	0.9	0.85
27			0.9	2.4		3.5		.09		0.8	0.9	0.85
28	1.4				2.7	3.4	1.4		1.0	0.85	0.9	0.8
29			1.0	2.2		3.3		0.9		0.85	0.8	0.75
30	1.5				2.8	3.1	1.3	1.0	0.9	0.8	0.9	0.75
31			0.9		2.8			0.9		0.9		0.75

NOTE.—Gage heights Jan. 7 to Feb. 11 and Nov. 14 to Dec. 31 distorted by ice.

Daily discharge, in second-feet, of North Fork of Sun River near Augusta, Mont., for 1911.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	250	510	395	1,350	3,920	2,320	630	340	340	340
2	270	520	420	1,400	5,000	2,320	630	340	435	362
3	290	530	420	1,450	5,000	2,320	630	340	495	340
4	310	540	420	2,580	4,640	2,320	630	418	435	320
5	330	540	420	3,710	4,280	2,190	630	495	385	320
6	350	540	420	3,320	3,920	2,190	710	562	435	320
7	370	570	420	2,970	4,350	2,060	670	630	385	320
8	390	600	395	2,740	4,780	1,940	630	508	340	320
9	410	560	370	2,520	4,240	1,710	670	385	385	320
10	440	520	370	2,380	3,710	1,600	710	385	340	320
11	460	480	370	2,250	4,140	1,300	710	410	340	340
12	480	480	370	2,670	4,570	1,120	710	435	385	385
13	480	480	405	3,090	5,000	1,080	710	410	340	410
14	480	450	440	3,500	5,340	1,030	670	385	340	400
15	480	420	480	3,920	5,690	1,030	630	385	385	390
16	480	375	450	4,340	4,700	950	532	385	385	380
17	480	330	420	3,140	3,710	910	435	385	385	370
18	450	330	480	2,970	3,610	870	410	385	435	360
19	420	330	540	2,610	3,520	870	385	385	495	350
20	420	350	805	2,250	3,430	870	385	362	435	340
21	430	370	1,070	2,250	3,430	750	385	340	385	320
22	440	455	1,160	2,250	3,430	630	385	340	435	300
23	450	540	1,250	2,250	3,340	670	385	362	385	300
24	460	480	1,160	2,250	3,250	710	362	385	385	300
25	470	420	1,350	2,120	3,160	790	340	385	385	290
26	480	395	1,450	2,000	3,080	740	340	385	320	290
27	490	370	1,550	1,940	2,920	680	340	385	300	290
28	500	395	1,450	1,880	2,760	630	340	385	320	280
29	.....	420	1,350	1,940	2,610	595	340	362	320	280
30	.....	395	1,350	2,000	2,320	560	385	340	300	280
31	.....	370	.....	2,000	.....	595	340	.....	340	.....

NOTE.—Daily discharge determined from two rating curves that are well defined and are used for periods from Feb. 12 to June 17, and from June 18 to Nov. 12, respectively. Discharge estimated Feb. 1 to 11, Nov. 14 to 30, and on days for which gage heights are missing.

Monthly discharge of North Fork of Sun River near Augusta, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 250	15,400	C.
February	500	250	420	23,300	B.
March	600	330	454	27,900	B.
April	1,550	370	732	43,600	B.
May	4,340	1,350	2,520	155,000	B.
June	5,690	2,320	3,930	234,000	B.
July	2,320	560	1,240	76,200	B.
August	710	340	518	31,900	B.
September	630	340	400	23,800	B.
October	495	300	380	23,400	B.
November	410	280	331	19,700	C.
December	.....	.....	[a] 275	16,900	D.
The year	.....	.....	954	691,000	

[a] Estimated.

SUN RIVER AT SUN RIVER, MONT.

Location.—At the highway bridge at Sun River, Mont. The principal tributaries of Sun River all enter above the station; South Fork of Sun River, Willow Creek, and Simms Creek are the most important.

Records available.—July 31, 1905, to December 31, 1911.

Drainage area.—Not measured.

Gage.—A staff nailed to piling on the left bank just above the bridge; datum unchanged.

Channel.—Shifts at all stages.

Discharge measurements.—Made from bridge or by wading.

Diversions.—Practically the entire valley above this point is irrigated with water taken from the river.

Accuracy.—Conditions at the measuring section have been very poor since the high water of 1907; at low stages good measurements can be made.

Discharge measurements of Sun River at Sun River, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 25	C. S. Heidel	2.95	702	Aug. 9	R. Richards	3.19	595
May 16	B. E. Jones	7.75	5,860	15	J. C. Beebe	2.86	412
June 26	do	5.48	2,660	Dec. 11	B. E. Jones	2.63	437

Daily gage height, in feet, of Sun River at Sun River, Mont., for 1911.

[R. A. Lange, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		2.8	4.1	5.4	5.4	2.6	2.6	2.9	2.7
2		2.9	4.2	5.9	5.0	2.7	2.6	3.0	2.8
3		2.9	4.5	7.6	4.8	2.8	2.6	3.3	2.8
4		2.9	4.6	7.4	4.8	2.7	3.2	3.6	2.8
5		2.9	4.8	7.2	4.6	3.3	3.2	3.3	2.7
6		2.8	5.0	6.6	4.2	3.4	3.2	3.2	2.7
7		2.8	7.0	7.2	4.2	3.3	3.1	3.0	2.6
8		2.7	6.4	7.2	4.0	3.2	3.0	3.0	2.6
9		2.7	5.6	7.1	3.8	3.2	3.0	3.0	2.3
10		2.8	5.6	7.0	3.6	3.2	3.0	3.0	2.2
11		2.8	5.2	7.8	3.5	3.2	3.0	2.8	2.2
12		2.7	5.0	7.6	3.5	3.0	3.0	3.0	2.3
13		2.7	5.0	7.5	3.6	2.8	3.0	3.0	2.6
14		2.7	4.8	7.4	3.6	2.8	3.0	3.0	3.3
15		2.7	5.0	7.2	3.4	2.8	3.0	3.0	3.4
16		2.8	7.0	7.2	3.4	2.8	3.0	3.0	3.3
17		2.8	7.0	7.0	3.3	2.7	3.0	3.0	
18		3.0	6.6	7.0	3.4	2.7	3.0	3.0	
19		3.0	5.8	6.8	3.3	2.6	2.9	3.0	
20		3.0	5.6	6.6	3.2	2.6	2.9	3.0	
21		3.2	5.5	6.9	3.2	2.6	3.0	3.0	
22		3.8	5.4	6.8	3.3	2.5	3.0	3.0	
23		4.1	5.4	6.6	3.1	2.4	2.9	3.0	
24		4.0	5.4	6.4	3.0	2.4	2.9	2.9	
25		4.6	5.2	6.2	3.0	2.5	3.0	2.9	
26	3.0	4.6	5.2	6.0	3.0	2.5	3.0	2.9	
27	2.8	5.0	5.0	5.8	3.0	2.6	2.9	2.8	
28	2.8	5.0	5.0	5.5	2.8	2.6	2.9	2.8	
29	2.7	4.6	4.9	5.4	2.8	2.6	3.0	2.8	
30	2.8	4.2	4.6	5.4	2.8	2.6	3.0	2.8	
31	2.8		4.8		2.6	2.6		2.8	

Daily discharge, in second-feet, of Sun River at Sun River, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	630	1,500	2,510	2,510	310	350	440	430
2	.....	680	1,580	3,120	2,080	350	350	480	470
3	.....	680	1,830	5,620	1,880	390	350	700	470
4	.....	680	1,920	5,300	1,880	370	650	900	470
5	.....	680	2,110	4,980	1,680	650	650	700	430
6	.....	630	2,310	4,080	1,320	710	650	670	430
7	.....	630	4,780	4,980	1,320	650	540	480	390
8	.....	580	3,960	4,980	1,150	590	480	480	390
9	.....	580	2,960	4,830	990	590	480	480	275
10	.....	630	2,960	4,680	850	590	480	480	240
11	.....	630	2,510	5,940	780	590	480	440	240
12	.....	580	2,310	5,620	780	490	480	480	275
13	.....	580	2,310	5,460	850	390	480	480	390
14	.....	580	2,110	5,300	850	390	480	480	740
15	.....	580	2,310	4,980	710	390	480	480	800
16	.....	630	4,780	4,980	710	390	480	570	740
17	.....	630	4,680	4,680	650	350	480	570	.....
18	.....	730	4,080	4,680	710	350	480	570	.....
19	.....	730	2,990	4,380	650	310	440	570	.....
20	.....	730	2,750	4,080	590	310	440	570	.....
21	.....	850	2,630	4,530	590	310	480	570	.....
22	.....	1,260	2,510	4,380	650	280	480	570	.....
23	.....	1,500	2,510	4,080	540	250	440	570	.....
24	.....	1,420	2,510	3,800	430	250	440	520	.....
25	.....	1,920	2,290	3,520	490	280	480	520	.....
26	730	1,920	2,290	3,250	490	280	480	520	.....
27	630	2,310	2,080	2,990	490	310	440	470	.....
28	630	2,310	2,080	2,630	390	310	440	470	.....
29	580	1,920	1,980	2,510	390	310	480	470	.....
30	630	1,580	1,680	2,510	390	310	480	470	.....
31	630	.....	1,880	.....	310	310	.....	470	.....

NOTE.—Daily discharge determined as follows: Mar. 25 to May 16 and May 17 to Aug. 31 from two fairly well-defined curves; Sept. 1 to Nov. 16, by indirect method for shifting channels.

Monthly discharge of Sun River at Sun River, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 350	21,500	D.
February	.....	.....	[a] 500	27,800	D.
March	730	.....	572	35,200	C.
April	2,310	580	993	59,100	B.
May	4,780	1,500	2,620	161,000	B.
June	5,940	2,510	4,310	256,000	B.
July	2,510	310	908	55,800	B.
August	710	250	398	24,500	B.
September	650	350	478	28,400	C.
October	900	440	538	33,100	C.
November	800	240	473	28,100	C.
December	.....	.....	[a] 400	24,600	D.
The year	5,940	.....	1,040	755,000	

[a] Estimated.

NOTE.—Discharge Mar. 1 to 24 and Nov. 17 to 30 estimated at 550 second-feet and 500 second-feet per day, respectively.

WILLOW CREEK NEAR AUGUSTA, MONT.

Location.—At Jordan's ranch, just below the mouth of Little Willow Creek and about 7 miles northwest of Augusta.

Records available.—June 8, 1905, to May 14, 1911.

Drainage area.—Not measured.

Gage.—A standard chain on right bank near observer's footbridge; datum unchanged.

Channel.—Permanent.

Winter flow.—No ice forms at this station as a large spring enters the creek just above the gage.

Diversions.—Water is diverted from the creek above the station for irrigation of the valley lands.

Storage.—Willow Creek dam, work on which has been begun, will provide a reservoir with a capacity of 84,320 acre-feet.

Accuracy.—Conditions for obtaining accurate discharge data are excellent.

Discharge measurements of Willow Creek near Augusta, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 14	John C. Beebe	0.65	3.5
Mar. 23	do	.96	9.5
May 19	B. E. Jones	1.58	36
June 9	J. C. Beebe	2.56	83
July 27	R. Richards	.95	13

Daily gage height, in feet, and discharge, in second-feet, of Willow Creek near Augusta, Mont., for 1911.

[Elizabeth Ireland, observer.]

Day.	January.		February.		March.		April.		May.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	0.66	4.0	0.66	4.0	0.60	3.0	0.91	9.1	0.90	8.8
2	.62	3.3	.67	4.1	.60	3.0	.90	8.8	.90	8.8
3	.60	3.0	.67	4.1	.61	3.2	.92	9.3	.84	7.4
4	.61	3.2	.67	4.1	.62	3.3	.92	9.3	.84	7.4
5	.61	3.2	.67	4.1	.63	3.5	.90	8.8	.93	9.6
6	.63	3.5	.67	4.1	.65	3.8	1.00	11	1.03	12
7	.64	3.6	.67	4.1	.65	3.8	.93	9.6	.97	11
8	.64	3.6	.67	4.1	.65	3.8	.91	9.1	.98	11
9	.65	3.8	.67	4.1	.68	4.3	.91	9.1	.90	8.8
10	.64	3.6	.68	4.3	.71	4.8	.91	9.1	.90	8.8
11	.64	3.6	.68	4.3	.71	4.8	.90	8.8	.90	8.8
12	.63	3.5	.68	4.3	.74	5.4	.85	7.7	.85	7.7
13	.64	3.6	.68	4.3	.77	6.0	.89	8.6	.80	6.5
14	.64	3.6	.68	4.3	.80	6.5	.85	7.7	.80	6.5
15	.64	3.6	.67	4.1	.95	10.0	.80	6.5	.....	.....
16	.64	3.6	.65	3.8	.95	10	.80	6.5	.....	.....
17	.65	3.8	.65	3.8	.98	11	.80	6.5	.....	.....
18	.65	3.8	.65	3.8	.98	11	.80	6.5	.....	.....
19	.68	4.3	.65	3.8	1.01	12	.83	7.2	.....	.....
20	.70	4.6	.64	3.6	1.15	16	.80	6.5	.....	.....
21	.70	4.6	.63	3.5	1.05	13	.80	6.5	.....	.....
22	.69	4.4	.62	3.3	1.03	12	.80	6.5	.....	.....
23	.68	4.3	.60	3.0	1.06	13	.90	8.8	.....	.....
24	.67	4.1	.60	3.0	1.09	14	.89	8.6	.....	.....
25	.67	4.1	.60	3.0	1.03	12	.85	7.7	.....	.....
26	.66	4.0	.60	3.0	.95	10	.85	7.7	.....	.....
27	.65	3.8	.60	3.0	.95	10	.85	7.7	.....	.....
28	.65	3.8	.60	3.0	.96	10	.90	8.8	.....	.....
29	.65	3.8	.....	.....	.96	10	.90	8.8	.....	.....
30	.66	4.0	.....	.....	.94	9.8	.90	8.8	.....	.....
31	.66	4.0	.....	.....	.94	9.8	.....	.....	.....	.....

NOTE.—Daily discharge determined from a rating curve well defined at all gage heights.

Monthly discharge of Willow Creek River near Augusta, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	4.6	3.0	3.80	234	A.
February	4.3	3.0	3.79	210	A.
March	16.0	3.0	8.15	501	A.
April	11.0	6.5	8.19	487	A.
May 1-14	12.0	6.5	8.79	244	A.

SOUTH FORK OF SUN RIVER AT AUGUSTA, MONT.

Location.—In sec. 11, T. 20 N., R. 6 W., at the highway bridge on the road from Augusta to Craig, Mont., about half a mile from Augusta.

Records available.—December 2, 1904, to December 31, 1911.

Drainage area.—Not measured.

Gage.—The original gage was spiked to the cribwork of the right abutment on the downstream side of the bridge; a new gage was installed April 17, 1907, at a different datum and was used during 1907 and 1908; records for 1909, 1910, and 1911 are referred to the old gage.

Channel.—Shifting.

Discharge measurements.—High-stage measurements may be made from the highway bridge; low-stage measurements are made by wading.

Winter flow.—Affected by ice.

Diversions.—Water is diverted to irrigate the valley lands both above and below stations. During dry seasons the entire summer flow is utilized.

Discharge measurements of South Fork of Sun River at Augusta, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 15	John C. Beebe	(a)	19.7	June 25	B. E. Jones	1.85	189
Mar. 2	do	0.98	38	26	do	1.82	163
May 20	B. E. Jones	1.95	279	July 26	R. Richards	1.28	32
June 9	J. C. Beebe	2.44	459	Oct. 26	W. A. Lamb	1.42	44

a About 10 inches of ice over the entire river.

Daily gage height, in feet, of South Fork of Sun River at Augusta, Mont., for 1911.

[W. J. Auchard, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		0.9	1.0	2.3	1.8	1.3	1.2	1.5	1.4
2		.9	.9	2.6	1.8	1.3	1.2	1.4	1.7
3		.9	.9	2.7	1.8	1.3	1.2	1.6	1.5
4		.9	.9	2.5	1.7	1.3	1.4	1.5	1.4
5		.9	.9	2.3	1.7	1.4	1.4	1.5	1.4
6		.9	.9	2.3	1.7	1.4	1.5	1.5	1.4
7		.8	.9	2.2	1.6	1.4	1.5	1.5	1.4
8		.8	.9	2.5	1.6	1.4	1.5	1.5	1.4
9		.9	.9	2.4	1.6	1.4	1.5	1.5	1.7
10		.9	.9	2.3	1.6	1.4	1.5	1.5	2.2
11		.9	.9	2.2	1.5	1.3	1.5	1.5	2.3
12		.8	.9	2.2	1.5	1.3	1.5	1.5	2.7
13		.8	.9	2.2	1.5	1.3	1.5	1.5	2.7
14		.8	.9	2.1	1.5	1.3	1.5	1.5	2.7
15		.8	1.1	2.0	1.5	1.3	1.5	1.5	2.7

Daily gage height, in feet, of South Fork of Sun River at Augusta, Mont., for 1911—Con.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
16	.....	0.8	2.5	2.0	1.4	1.3	1.5	1.5	2.7
17	.....	.8	2.3	2.0	1.4	1.3	1.5	1.5	2.1
18	.....	.8	2.1	1.9	1.4	1.2	1.5	1.5	2.1
19	.....	.8	2.0	1.9	1.4	1.2	1.5	1.5	1.9
20	.....	.8	1.9	1.9	1.4	1.3	1.5	1.5	1.6
21	.....	.8	1.9	1.9	1.4	1.3	1.5	1.5	1.5
22	.....	.9	1.8	1.9	1.3	1.2	1.5	1.5	1.4
23	.....	1.0	1.8	1.9	1.3	1.2	1.5	1.5	1.5
24	1.6	.9	1.8	1.9	1.3	1.2	1.5	1.5	1.4
25	1.6	.9	1.8	1.9	1.3	1.2	1.5	1.5	.....
26	.9	1.0	1.9	1.8	1.3	1.2	1.5	1.5	.....
27	.9	1.0	1.9	1.8	1.3	1.2	1.5	1.5	.....
28	.9	1.0	1.8	1.8	1.2	1.2	1.5	1.4	.....
29	.9	1.0	1.8	1.8	1.2	1.2	1.5	1.4	.....
30	.9	1.0	1.9	1.8	1.2	1.2	1.5	1.4	.....
31	.9	.....	2.0	.....	1.2	1.2	.....	1.4	.....

NOTE.—Gage heights distorted by ice Mar. 24 to 25 and Nov. 1 to 24.

Daily discharge, in second-feet, of South Fork of Sun River at Augusta, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	38	30	45	400	160	30	20	65
2	38	30	30	520	160	30	20	45
3	38	30	30	560	160	30	20	90
4	38	30	30	480	120	30	45	65
5	37	30	30	400	120	45	45	65
6	37	30	30	400	120	45	65	65
7	37	20	30	365	90	45	65	65
8	36	20	30	480	90	45	65	65
9	36	30	30	440	90	45	65	65
10	36	30	30	390	90	45	65	65
11	35	30	30	340	65	30	65	65
12	35	20	30	340	65	30	65	65
13	35	20	30	340	65	30	65	65
14	34	20	30	290	65	30	65	65
15	34	20	60	245	65	30	65	65
16	34	20	480	245	45	30	65	65
17	33	20	400	245	45	30	65	65
18	33	20	330	200	45	20	65	65
19	33	20	295	200	45	20	65	65
20	32	20	260	200	45	30	65	65
21	32	20	260	200	45	30	65	65
22	32	30	230	200	30	20	65	65
23	31	45	230	200	30	20	65	65
24	30	30	230	200	30	20	65	65
25	30	30	230	200	30	20	65	65
26	30	45	260	160	30	20	65	65
27	30	45	260	160	30	20	65	65
28	30	45	230	160	20	20	65	45
29	30	45	230	160	20	20	65	45
30	30	45	260	160	20	20	65	45
31	30	.....	295	.....	20	20	.....	45

NOTE.—Daily discharges determined from two fairly well-defined rating curves for periods Mar. 26 to June 9 and June 10 to Oct. 31. Discharges estimated Mar. 1 to 23.

Monthly discharge of South Fork of Sun River at Augusta, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January			a 20	1,230	
February			a 25	1,390	
March	38	30	34	2,090	C.
April	45	20	29.0	1,730	B.
May	480	30	160	9,840	B.
June	560	160	296	17,600	B.
July	160	20	66.1	4,000	B.
August	45	20	29.0	1,780	B.
September	65	20	59.2	3,520	B.
October	90	45	62.6	3,850	B.
November			a 40	2,380	
December			a 25	1,540	
The year			70.5	51,000	

a Estimated.

FORD CREEK NEAR AUGUSTA, MONT.

Location.—At the ranch of Joseph Ford, 16 miles west of Augusta, Mont. Ford Creek unites with Smith Creek to form the South Fork of Sun River. Ford Creek has no tributary.

Records available.—April 11, 1906, to December 31, 1911.

Drainage area.—18 square miles.

Gage.—Staff, on the right bank near the observer's house; datum unchanged.

Channel.—Shifting; current swift.

Discharge measurements.—Made by wading.

Winter flow.—Little affected by ice.

Diversions.—One irrigation ditch, capacity about 15 sec.-ft., diverts water from the creek above the gage.

Accuracy.—As conditions of flow are changeable, frequent discharge measurements are necessary to properly define the rating curve.

Discharge measurements of Ford Creek near Augusta, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 15	J. C. Beebe	Ice.	10.1	June 24	B. E. Jones	1.64	53
Mar. 21	do	0.80	10.9	July 27	R. Richards	1.29	28
May 20	B. E. Jones	1.72	66.	Oct. 27	W. A. Lamb	1.10	12.8
June 9	J. C. Beebe	2.03	104				

Daily gage height, in feet, of Ford Creek near Augusta, Mont., for 1911.

[Joseph Ford, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		1.00	1.20	2.00	1.52	1.30	1.20
2		1.00	1.20	2.05	1.50	1.30	1.20
3		1.00	1.30	2.10	1.50	1.30	1.20
4		1.05	1.42	2.02	1.50	1.30	1.20
5		1.05	1.50	2.00	1.45	1.30	1.20
6		1.05	1.52	2.00	1.40	1.30	1.20
7		1.00	1.50	2.10	1.40	1.25	1.20
8		1.00	1.42	2.10	1.40	1.20	1.20
9		1.00	1.40	2.00	1.40	1.20	1.20
10		1.00	1.40	2.00	1.40	1.20	1.20

Daily gage height, in feet, of Ford Creek near Augusta, Mont., for 1911—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
11	.....	1.00	1.40	2.00	1.40	1.18	1.20
12	.....	1.00	1.40	1.92	1.40	1.15	1.20
13	.....	1.05	1.40	1.90	1.40	1.15	1.20
14	.....	1.00	1.40	1.90	1.40	1.15	1.18
15	.....	1.00	2.05	1.88	1.40	1.15	1.15
16	.....	.....	1.98	1.80	1.40	1.15	1.15
17	.....	1.00	1.85	1.80	1.40	1.20	1.15
18	.....	1.00	1.78	1.80	1.40	1.20	1.15
19	.....	1.00	1.70	1.80	1.40	1.20	1.15
20	.....	1.00	1.70	1.75	1.40	1.20	1.15
21	.....	1.00	1.70	1.70	1.38	1.20	1.15
22	.....	1.00	1.70	1.60	1.35	1.20	1.15
23	1.00	1.00	1.70	1.60	1.30	1.20	1.15
24	1.00	1.00	1.70	1.60	1.30	1.20	1.15
25	1.00	1.22	1.70	1.60	1.30	1.20	1.12
26	1.00	1.25	1.65	1.60	1.30	1.20	1.10
27	1.00	1.32	1.60	1.60	1.30	1.20	1.10
28	1.00	1.30	1.60	1.55	1.30	1.20	1.10
29	1.00	1.20	1.65	1.55	1.30	1.20	1.10
30	1.00	1.20	1.75	1.55	1.30	1.20	1.10
31	1.00	.....	1.85	.....	1.30	1.20	.....

Daily discharge, in second-feet, of Ford Creek near Augusta, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	10	13	21	100	44	26	18
2	10	13	21	107	42	26	18
3	10	13	27	114	42	26	18
4	10	15	36	103	42	26	18
5	10	15	42	100	38	26	18
6	10	15	44	100	34	26	18
7	10	13	42	114	34	23	18
8	10	13	36	114	34	21	18
9	10	13	34	100	34	21	18
10	10	13	34	100	34	21	18
11	11	13	34	100	34	20	18
12	11	13	34	89	34	17	18
13	11	15	34	86	34	17	17
14	11	13	34	86	34	17	16
15	11	13	107	84	34	17	15
16	11	13	97	74	34	17	15
17	11	13	80	74	34	19	15
18	11	13	72	74	34	19	15
19	11	13	62	74	34	19	15
20	11	13	62	68	34	19	15
21	11	13	62	62	33	19	15
22	12	13	62	52	30	19	15
23	13	13	62	52	27	19	15
24	13	13	62	52	27	19	15
25	13	22	62	52	27	19	14
26	13	24	57	52	27	19	14
27	13	28	52	52	27	19	14
28	13	27	52	47	26	18	13
29	13	21	57	47	26	18	13
30	13	21	68	47	26	18	13
31	13	.....	80	.....	26	18	.....

NOTE.—Daily discharge Mar. 23 to July 27 determined from a rating curve fairly well defined; discharge July 28 to Sept. 30 determined by indirect method for shifting channels; discharge Mar. 1 to 22 estimated.

Monthly discharge of Ford Creek near Augusta, Mont., for 1911.

[Drainage area, 18 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a] 10	0.556	0.64	615	D.
February	.....	.....	[a] 10	.556	.58	555	D.
March	.....	.....	[a] 11.3	.628	.72	695	C.
April	28	13	15.4	.856	.96	916	B.
May	107	21	52.5	2.92	3.37	3,230	B.
June	114	47	79.2	4.40	4.91	4,710	B.
July	44	26	32.9	1.83	2.11	2,020	B.
August	26	17	20.3	1.13	1.30	1,250	C.
September	18	13	16.0	.889	.99	952	C.
October	.....	.....	[a] 13	.722	.83	799	C.
November	.....	.....	[a] 10	.556	.62	595	D.
December	.....	.....	[a] 8	.444	.51	492	D.
The year	.....	.....	23.2	1.29	17.54	16,800	

[a] Estimated.

SMITH CREEK NEAR AUGUSTA, MONT.

Location.—At a point 1 mile above J. W. Nixon's ranch, 16 miles southwest of Augusta, Mont.

Records available.—April 14, 1906, to December 31, 1911.

Drainage area.—26 square miles.

Gage.—Inclined staff fastened to a bowlder on the left bank just above the ford.

Channel.—Shifts during high stages.

Discharge measurements.—Made by wading.

Winter flow.—Open entire year.

Diversions.—The ordinary summer flow of this creek is practically all used for irrigation, but no water is diverted above the gaging station.

Discharge measurements of Smith Creek near Augusta, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 16	J. C. Beebe	0.38	9.6	June 9	J. C. Beebe	1.25	131
Mar. 21	do	.48	13.4	24	B. E. Jones	.90	52
May 20	B. E. Jones	1.09	97	July 28	R. Richards	.56	23
June 7	J. C. Beebe	1.26	135	Oct. 27	W. A. Lamb	.14	12.3
7	do	1.26	127				

Daily gage height, in feet, of Smith Creek near Augusta, Mont., for 1911.

[Mrs. J. W. Nixon, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.5	0.7	1.75	0.8	0.5	0.5	0.6	0.35	0.45
2	.....	.5	.7	1.8	.8	.5	.5	.65	.55	.45
3	.....	.5	.7	1.7	.8	.5	.5	.7	.55	.45
4	.....	.5	.8	1.6	.75	.5	.55	.6	.55	.45
5	.....	.5	.9	1.4	.75	.5	.65	.6	.55	.45
6	.....	.5	1.0	1.3	.7	.5	.65	.6	.55	.4
7	.....	.5	.95	1.25	.7	.5	.7	.6	.55	.4
8	.....	.5	.9	1.35	.65	.5	.75	.6	.5	.4
9	.....	.5	.9	1.25	.65	.5	.75	.6	.5	.4
10	.....	.5	.9	1.2	.65	.5	.75	.6	.5	.4
11	0.3	.5	.9	1.2	.65	.5	.8	.6	.5	.4
12	.3	.5	.85	1.15	.65	.5	.8	.6	.5	.35
13	.3	.5	.9	1.15	.65	.5	.75	.6	.5	.35
14	.3	.5	.95	1.1	.65	.5	.75	.6	.5	.35
15	.3	.5	2.4	1.1	.7	.5	.7	.6	.5	.35
16	.3	.5	1.7	1.0	.7	.5	.7	.6	.5	.35
17	.3	.5	1.45	1.0	.65	.5	.65	.6	.5	.35
18	.3	.5	1.3	1.0	.65	.5	.65	.6	.5	.35
19	.4	.5	1.2	1.0	.65	.5	.6	.6	.5	.35
20	.45	.55	1.1	.9	.65	.5	.6	.6	.5	.35
21	.5	.55	1.1	.9	.65	.5	.6	.6	.5	.35
22	.5	.6	1.05	.9	.6	.5	.6	.6	.5	.35
23	.5	.65	1.0	.85	.6	.5	.6	.6	.5	.35
24	.5	.7	1.0	.9	.6	.5	.6	.6	.5	.35
25	.5	.7	1.0	.9	.55	.5	.6	.6	.5	.35
26	.5	.8	1.0	.9	.55	.5	.6	.6	.5	.35
27	.5	.75	1.0	.85	.55	.5	.6	.6	.5	.35
28	.5	.7	1.1	.85	.55	.5	.6	.6	.5	.35
29	.5	.7	1.1	.85	.6	.5	.6	.6	.5	.35
30	.5	.7	1.15	.8	.6	.5	.6	.55	.5	.35
31	.5	.....	1.5	.....	.6	.5	.....	.55	.....	.35

Daily discharge, in second-feet, of Smith Creek near Augusta, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6	15	34	252	47	15	15	23	19	12
2	6	15	34	264	47	15	15	28	19	12
3	6	15	34	239	47	15	15	34	19	12
4	6	15	47	214	40	15	19	23	19	12
5	6	15	62	164	40	15	28	23	19	12
6	6	15	80	141	34	15	28	23	19	9
7	6	15	71	130	34	15	34	23	19	9
8	6	15	62	152	28	15	40	23	15	9
9	6	15	62	130	28	15	40	23	15	9
10	6	15	62	119	28	15	40	23	15	9
11	6	15	62	119	28	15	47	23	15	9
12	6	15	54	108	28	15	47	23	15	7.5
13	6	15	62	108	28	15	40	23	15	7.5
14	6	15	71	98	28	15	40	23	15	7.5
15	6	15	414	98	34	15	34	23	15	7.5
16	6	15	239	80	34	15	34	23	15	7.5
17	6	15	176	80	28	15	28	23	15	7.5
18	6	15	141	80	28	15	28	23	15	7.5
19	9	15	119	80	28	15	23	23	15	7.5
20	12	19	98	62	28	15	23	23	15	7.5
21	15	19	98	62	28	15	23	23	15	7.5
22	15	23	89	62	23	15	23	23	15	7.5
23	15	28	80	54	23	15	23	23	15	7.5
24	15	34	80	62	23	15	23	23	15	7.5
25	15	34	80	62	19	15	23	23	15	7.5
26	15	47	80	62	19	15	23	23	15	7.5
27	15	40	80	54	19	15	23	23	15	7.5
28	15	34	98	54	19	15	23	23	15	7.5
29	15	34	98	54	15	15	23	23	15	7.5
30	15	34	108	47	15	15	23	19	15	7.5
31	15	.....	189	.....	15	15	.....	19	.....	7.5

NOTE.—Daily discharge determined from a rating curve well defined below 165 second-feet. Discharge estimated Mar. 1 to 10.

Monthly discharge of Smith Creek near Augusta, Mont., for 1911.

[Drainage area, 26 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a] 10.0	0.385	0.44	615	C.
February	.....	.....	[a] 8.0	.308	.32	444	D.
March	15	.....	9.5	.365	.42	581	C.
April	47	15	21.0	.808	.90	1,250	B.
May	414	34	98.8	3.80	4.38	6,080	B.
June	264	47	110	4.23	4.72	6,550	B.
July	47	15	28.5	1.10	1.27	1,750	B.
August	15	15	15.0	.577	.67	922	B.
September	47	15	28.3	1.09	1.22	1,680	B.
October	34	19	23.3	.896	1.03	1,430	B.
November	19	15	15.9	.612	.68	946	B.
December	12	7.5	8.52	.328	.38	524	B.
The year	414	.....	31.5	1.21	16.43	22,800	

[a] Estimated.

MARIAS RIVER BASIN.

MARIAS RIVER NEAR SHELBY, MONT.

Location.—At the highway bridge near James A. Johnson's ranch, 7 miles south of Shelby, Mont.

Records available.—April 4, 1902, to June 30, 1906; March 21 to December 31, 1911.

Drainage area.—2,610 square miles.

Gages.—A standard chain gage fastened to the up-stream guardrail of the bridge was read during 1905–6; a Bristol automatic and a staff gage were set when the station was reestablished in 1911. The new gages are at practically the same datum as the old gage.

Channel.—Straight for 100 yards above and 200 yards below the station; right bank sandy, sloping, and liable to overflow; left bank high and protected by sheet piling and a plank wall. Bed composed of sand and gravel with some cobblestones. Liable to shift after freshets. Only one channel at all stages. Current is of moderate velocity and sets toward the left bank as it rounds a sharp curve some distance above.

Discharge measurements.—Made from highway bridge, lower chord of which is about 15 feet above low water.

Winter flow.—Affected by ice.

Discharge measurements of Marias River near Shelby, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 21	C. S. Heidel	[a] 5.91	1,170	Aug. 14	J. C. Beebe	3.59	810
May 13	do	5.0	2,260	Oct. 3	C. S. Heidel	4.42	1,770
June 28[b]	do	5.08	2,430	18	B. E. Jones	3.96	1,120

[a] Ice present. [b] New chain gage placed same datum as staff but different section.

Daily gage height, in feet, of Marias River near Shelby, Mont., for 1911.

[Orin Hughes, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.6	5.5	5.0	3.5	3.1	4.3	3.65	4.1
2	.....	4.6	6.05	4.8	3.7	3.1	4.4	3.6	4.0
3	.....	4.8	6.55	4.7	3.8	3.0	4.4	3.6	4.05
4	.....	5.0	6.7	4.6	3.8	3.8	4.4	3.6	4.05
5	.....	5.4	6.5	4.5	3.7	4.7	4.3	3.55	3.95
6	.....	5.8	6.2	4.4	3.6	6.5	4.2	3.55	3.95
7	.....	5.75	5.95	4.3	3.7	6.1	4.1	3.4	3.9
8	.....	5.6	5.95	4.2	3.7	5.4	4.1	3.3	3.95
9	.....	5.6	5.9	4.2	3.9	5.1	4.1	2.9	3.95
10	.....	5.5	5.7	4.1	3.8	.....	4.0	2.7	.....
11	.....	5.3	5.7	4.0	3.9	5.0	3.9	2.9	.....
12	.....	5.2	5.75	3.9	3.8	5.1	3.8	3.3	3.8
13	.....	5.1	5.95	3.8	3.7	.....	3.7	3.5	3.8
14	.....	5.2	5.95	3.8	3.6	5.0	3.7	3.8	3.85
15	.....	5.4	5.95	3.7	3.6	4.7	3.8	3.8	3.7
16	.....	6.95	5.9	3.8	3.5	4.5	4.0	3.85	3.7
17	.....	7.75	5.7	3.8	3.5	4.6	3.9	3.9	3.7
18	.....	7.25	5.45	3.7	3.4	4.5	3.95	4.1	3.75
19	.....	6.65	5.35	3.7	3.4	4.4	3.9	4.2	3.8
20	.....	6.15	5.25	3.7	3.3	4.3	3.9	4.3	3.9
21	.....	5.7	5.2	3.7	3.3	4.2	3.85	.....	3.85
22	.....	5.7	5.35	3.7	3.2	4.3	3.85	.....	3.8
23	4.4	5.6	5.55	.....	3.3	.....	3.8	4.4	3.9
24	4.35	5.55	6.1	3.6	3.4	.....	3.8	4.5	3.85
25	4.7	5.55	6.7	3.6	3.3	.....	3.75	4.5	3.8
26	5.0	5.45	6.35	3.5	3.3	.....	3.7	4.4	3.7
27	5.2	5.3	5.65	3.5	3.4	4.4	3.6	4.35	3.7
28	5.05	5.2	5.1	3.4	3.4	4.5	3.6	4.2	.....
29	5.05	5.15	.....	3.4	3.3	4.4	3.7	4.2	.....
30	4.7	5.15	.....	3.4	3.2	4.4	3.7	4.1	.....
31	.....	5.25	.....	3.4	3.2	.....	3.65	.....	.....

NOTE.—Gage heights Nov. 12 to 30 distorted by ice.

Daily discharge, in second-feet, of Marias River near Shelby, Mont., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1,830	2,960	2,310	750	480	1,500	870
2	.....	1,830	3,730	2,070	910	480	1,610	830
3	.....	2,070	4,430	1,950	1,000	430	1,610	830
4	.....	2,310	4,640	1,830	1,000	1,000	1,610	830
5	.....	2,830	4,360	1,720	910	1,950	1,500	790
6	.....	3,380	3,940	1,610	830	4,360	1,390	790
7	.....	3,310	3,590	1,500	910	3,800	1,290	680
8	.....	3,100	3,590	1,390	910	2,830	1,290	610
9	.....	3,100	3,520	1,390	1,090	2,440	1,290	380
10	.....	2,960	3,240	1,290	1,000	2,380	1,190	300
11	.....	2,700	3,240	1,190	1,090	2,310	1,090	380
12	.....	2,570	3,310	1,090	1,000	2,440	1,000	370
13	.....	2,440	3,590	1,000	910	2,380	910	360
14	.....	2,570	3,590	1,000	830	2,310	910	350
15	.....	2,830	3,590	910	830	1,950	1,000	340
16	.....	4,990	3,520	1,000	750	1,720	1,190	330
17	.....	6,110	3,240	1,000	750	1,830	1,090	320
18	.....	5,410	2,900	910	680	1,720	1,140	310
19	.....	4,570	2,760	910	680	1,610	1,090	300
20	.....	3,870	2,640	910	610	1,500	1,090	290
21	.....	3,240	2,570	910	610	1,390	1,040	280
22	.....	3,240	2,760	910	540	1,500	1,040	270
23	1,610	3,100	3,030	870	610	1,520	1,000	260
24	1,560	3,030	3,800	830	680	1,540	1,000	250
25	1,950	3,030	4,640	830	610	1,570	955	250
26	2,310	2,900	4,150	750	610	1,590	910	250
27	2,570	2,700	3,170	750	680	1,610	830	250
28	2,380	2,570	2,440	680	680	1,720	830	250
29	2,380	2,500	2,440	680	610	1,610	910	250
30	1,950	2,500	2,310	680	540	1,610	910	250
31	.....	2,640	.....	680	540	.....	870	.....

NOTE.—Daily discharge determined from a rating curve well defined between 750 and 2,960 second-feet. Discharge estimated Nov. 12 to 30 and for days for which gage heights are missing.

Monthly discharge of Marias River near Shelby, Mont., for 1911.

[Drainage area, 2,610 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
April 23-30	2,570	1,560	2,090	0.801	0.24	33,200	A.
May	6,110	1,830	3,100	1.19	1.37	191,000	B.
June	4,640	2,310	3,390	1.30	1.45	202,000	B.
July	2,310	680	1,150	.441	.51	70,700	A.
August	1,090	540	779	.298	.34	47,900	A.
September	4,360	430	1,850	.709	.79	110,000	A.
October	1,610	830	1,130	.433	.50	69,500	A.
November	870	250	427	.164	.18	25,400	C.
December			[a] 250	.096	.11	15,400	D.
The period						765,000	

[a] Estimated.

TWO MEDICINE RIVER AT FAMILY, MONT.

Location.—In the NE. ¼ NE. ¼ sec. 2, T. 31 N., R. 9 W., at the Holy Family Mission, 16 miles southeast of Browning, Mont., and about 6 miles above the mouth of Badger Creek, the nearest tributary.

Records available.—April, 1907, to December 31, 1911.

Drainage area.—368 square miles.

Gage.—Standard chain on the east bank of the stream directly back of the Mission buildings; datum of gage was lowered 0.95 foot July 21, 1908.

Channel.—Gravel.

Discharge measurements.—Low-water measurements made by wading at section near the gage; high-water measurements must be made from the old wagon bridge about 3 miles above the Mission.

Winter flow.—Affected by ice.

Diversions and storage.—Water is diverted at a point about 2 miles above the gage by a ditch which supplies water for about 100 acres of land on the farm at the Holy Family Mission. The United States Reclamation Service has under construction a project which will use about 200 second-feet of water for irrigating land north of the stream for the Blackfeet Indians. The water will be diverted near the mouth of Little Badger Creek, a small tributary entering from the south above the station. A storage reservoir will be built at Two Medicine Lake near the headwaters of the stream to augment the low-water flow.

Accuracy.—Results at this station are good except during the winter months.

Discharge measurements of Two Medicine River at Family, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 1[a]	B.E. Jones	4.32	53	June 12	B. E. Jones	3.95	1,400
Mar. 16	do	1.56	72	July 14	W. A. Lamb	2.25	324
May 11	do	3.63	1,170				

[a] Ice at gage.

Daily gage height, in feet, of Two Medicine River at Family, Mont., for 1911.

[Walter Owens, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.3	3.2	3.8	2.95	1.9	1.7	2.5	1.8
2	.....	2.2	3.4	4.3	2.85	1.85	1.65	2.5	1.8
3	.....	2.1	3.6	4.5	2.8	1.9	1.6	2.55	1.8
4	.....	2.0	3.8	4.5	2.75	1.85	3.4	2.5	1.8
5	.....	1.9	4.3	4.2	2.7	1.85	3.6	2.4	1.75
6	.....	1.9	4.6	4.0	2.75	1.9	3.3	2.35	1.7
7	.....	1.95	3.9	4.0	2.65	1.95	3.15	2.3	1.75
8	2.5	2.0	4.0	3.9	2.6	1.95	3.0	2.25	1.8
9	1.5	2.05	4.2	3.7	2.6	2.0	3.05	2.2	1.75
10	1.4	2.25	3.6	3.7	2.5	2.1	3.1	2.15	1.75
11	1.9	2.2	3.45	3.8	2.4	2.0	3.2	2.15	1.8
12	2.3	2.1	3.5	4.0	2.35	1.95	3.15	2.2	.....
13	1.45	2.1	3.6	3.9	2.3	1.95	3.1	2.35	.....
14	1.5	2.0	3.7	4.0	2.25	1.95	3.0	2.25	.....
15	1.5	2.0	3.6	3.9	2.25	1.9	2.9	2.2	.....
16	1.6	2.2	6.8	3.8	2.2	1.85	2.95	2.2	.....
17	1.6	2.55	5.2	3.8	2.25	1.85	2.8	2.2	.....
18	1.6	2.75	4.6	3.5	2.25	1.8	2.65	2.15	.....
19	1.7	2.7	4.3	3.5	2.2	1.8	2.55	2.1	.....
20	1.8	3.1	4.0	3.45	2.15	1.85	2.45	2.0	.....
21	2.0	3.6	3.7	3.35	2.15	1.8	2.45	1.95	.....
22	2.2	3.8	3.8	3.4	2.1	1.8	2.6	1.95	.....
23	2.35	3.6	3.6	3.35	2.05	1.75	2.6	2.0	.....
24	2.6	3.4	3.5	3.45	1.9	1.75	2.65	2.05	.....
25	2.6	3.9	3.3	3.8	2.0	1.8	2.7	2.0	.....
26	2.25	4.2	3.3	3.3	1.95	1.8	2.75	1.95	.....
27	2.2	4.2	3.2	3.25	1.95	1.8	2.8	1.9	.....
28	2.0	3.5	3.3	3.2	1.8	1.75	2.65	1.85	.....
29	2.05	3.3	3.2	3.05	1.9	1.7	2.55	1.85	.....
30	2.25	3.15	3.3	3.05	1.85	1.6	2.5	1.9	.....
31	2.3	.....	3.35	.....	1.95	1.7	.....	1.85	.....

NOTE.—Gage heights distorted by ice Mar. 8 to 12.

Daily discharge, in second-feet, of Two Medicine River at Family, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	50	325	855	1,320	988	167	107	425	135
2	50	280	1,000	1,770	625	151	96	425	135
3	51	240	1,150	1,950	595	167	84	452	135
4	51	202	1,320	1,950	565	151	1,000	425	135
5	52	167	1,770	1,680	535	151	1,150	375	121
6	52	167	2,040	1,490	565	167	925	350	107
7	53	184	1,400	1,490	508	184	820	325	121
8	54	202	1,490	1,400	480	184	720	302	135
9	55	221	1,680	1,230	480	202	752	280	121
10	56	302	1,150	1,230	425	240	785	260	121
11	57	280	1,040	1,320	375	202	855	260	135
12	58	240	1,080	1,490	350	184	820	280	.....
13	58	240	1,150	1,400	325	184	785	350	.....
14	65	202	1,230	1,490	302	184	720	302	.....
15	65	202	1,150	1,400	302	167	655	280	.....
16	84	280	4,140	1,320	280	151	688	280	.....
17	84	452	2,620	1,320	302	151	595	280	.....
18	84	565	2,040	1,080	302	135	508	260	.....
19	107	535	1,770	1,080	280	135	452	240	.....
20	135	785	1,490	1,040	260	151	400	202	.....
21	202	1,150	1,230	962	260	135	400	184	.....
22	280	1,320	1,320	1,000	240	135	480	184	.....
23	330	1,150	1,150	962	221	121	480	202	.....
24	480	1,000	1,080	1,040	167	121	508	221	.....
25	480	1,400	925	1,320	202	135	535	202	.....
26	302	1,680	925	925	184	135	565	184	.....
27	280	1,680	855	890	184	135	595	167	.....
28	202	1,000	925	855	135	121	508	151	.....
29	221	925	855	752	167	107	452	151	.....
30	302	820	925	752	151	84	425	167	.....
31	325	.....	962	.....	184	107	.....	151	.....

NOTE.—Daily discharge determined from a well-defined rating curve. Discharges Mar. 1 to 12 estimated.

Monthly discharge of Two Medicine River at Family, Mont., for 1911.

[Drainage area, 368 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	50	0.136	0.16	3,070	C.
February	.....	.....	50	.136	.14	2,780	C.
March	480	.....	153	.416	.48	9,410	B.
April	1,680	167	609	1.65	1.84	36,200	A.
May	4,140	855	1,380	3.75	4.32	84,800	B.
June	1,950	752	1,260	3.42	3.82	75,000	A.
July	988	135	353	.959	1.11	21,700	A.
August	240	84	153	.416	.48	9,410	A.
September	1.150	84	596	1.62	1.81	35,500	A.
October	452	151	268	.728	.84	16,500	A.
November	.....	.....	120	.326	.36	7,140	C.
December	.....	.....	90	.244	.28	5,530	D.
The year	4,140	.....	424	1.15	15.64	307,000	

NOTE.—Means for January, February, and December, estimated; mean for period Nov. 12–30 estimated at 115 second-feet.

BADGER CREEK NEAR FAMILY, MONT.

Location.—In the NE. ¼ sec. 19, T. 31 N., R. 8 W., near the road crossing, 4 miles east of Family, Mont.

Records available.—April 20, 1907, to December 31, 1911.

Drainage area.—224 square miles.

Gage.—Chain. The original staff gage established April 20, 1907, and bench marks were washed out in June, 1908, and a new gage was established July 22, 1908, about 400 feet farther upstream and at a different datum; as the bench mark was also destroyed the relation between the two gages could not be determined. The gage was again washed out on May 25, 1909, and was reset at a different datum and 400 feet below the old Piegan Mission crossing.

Channel.—Two channels at both medium and low stages; at high stages the stream flows in several channels.

Discharge measurements.—High-water measurements made from a cable 4 miles above the gage; low-water measurements can be made by wading at the ford above the gage.

Diversions.—The United States Reclamation Service proposes to divert the natural flow of Badger Creek to irrigate land in the eastern part of the Blackfeet Indian Reservation north of Birch Creek.

Accuracy.—High-water measurements are only fair; low-water records are, however, good.

Discharge measurements of Badger Creek near Family, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 1[a]	B. E. Jones	3.8	30	June 27	W. A. Lamb	4.79	557
Mar. 16[a]	.....do	5.52	73	July 14	.....do	4.24	269
May 11	.....do	4.80	576	Aug. 30	B. E. Jones	3.86	146
June 11	.....do	5.07	809	Oct. 16	.....do	4.47	368

[a] Ice measurement.

Daily gage height, in feet, of Badger Creek near Family, Mont., for 1911.

[Oliver J. Racine, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.85	4.55	5.2	.....	4.1	3.9	4.7	4.2
2	.....	3.85	4.7	5.35	4.7	4.1	3.95	4.7	4.2
3	.....	3.85	4.75	5.4	.....	4.1	4.0	4.7	4.2
4	.....	3.85	4.85	5.3	.....	4.15	4.3	4.6	4.2
5	.....	3.85	4.85	5.15	4.55	.....	4.95	4.6	4.2
6	.....	3.8	4.95	5.1	4.5	4.1	4.85	4.6	4.2
7	.....	3.75	5.0	5.15	4.5	4.1	4.85	4.6	4.25
8	.....	3.75	5.0	5.1	4.45	4.1	4.85	4.5	4.3
9	.....	3.75	5.0	5.1	4.4	4.1	4.85	4.45	4.3
10	.....	3.8	4.85	5.1	4.35	4.1	4.85	4.4	4.4
11	.....	3.9	4.8	5.15	4.4	4.1	4.9	4.45	4.4
12	.....	3.9	4.8	5.1	4.4	4.1	4.85	4.5	.....
13	.....	3.85	4.85	5.15	4.35	4.1	4.9	4.6	.....
14	.....	3.85	4.9	5.2	4.3	4.1	4.85	4.6	.....
15	.....	3.85	5.1	5.05	4.3	4.05	4.8	4.5	.....
16	.....	3.9	5.35	5.0	4.25	4.05	4.75	4.5	.....
17	.....	3.95	5.25	4.95	4.25	4.0	4.7	4.25	.....
18	.....	4.0	5.15	4.9	4.25	3.95	4.65	4.3	.....
19	3.9	4.15	5.0	4.85	4.2	3.9	4.6	4.4	.....
20	3.9	4.25	4.95	4.85	4.2	3.95	4.65	4.4	.....
21	4.0	4.5	4.95	4.8	4.2	3.9	4.7	4.4	.....
22	4.0	4.55	5.0	4.8	4.2	3.9	4.7	4.4	.....
23	3.95	4.7	5.0	4.85	4.15	3.9	4.7	4.35	.....
24	3.95	4.7	4.95	5.0	4.15	3.9	4.7	4.3	.....
25	3.9	4.75	4.85	4.95	4.1	3.9	4.65	4.3	.....
26	3.85	4.9	4.8	4.9	4.1	3.9	4.65	4.2	.....
27	3.85	4.85	4.75	4.85	4.05	3.9	4.65	4.2	.....
28	3.9	4.75	4.7	4.8	4.05	3.9	4.65	4.2	.....
29	3.9	4.65	4.65	4.75	4.05	3.9	4.65	4.2	.....
30	3.85	4.55	4.75	4.8	4.05	3.9	4.7	4.2	.....
31	3.85	.....	4.95	.....	4.1	3.9	.....	4.2	.....

NOTE.—Gage heights distorted by ice Mar. 19 to 31 and Nov. 7 to 11.

Daily discharge, in second-feet, of Badger Creek near Family, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	25	150	412	905	532	215	160	500
2	28	150	500	1,060	500	215	172	500
3	31	150	532	1,120	470	215	185	500
4	34	150	600	1,010	440	232	290	440
5	37	150	600	855	412	224	675	440
6	40	140	675	805	385	215	600	440
7	43	132	715	855	385	215	600	440
8	46	132	715	805	360	215	600	385
9	49	132	715	805	335	215	600	360
10	52	140	600	805	312	215	600	335
11	55	160	565	855	335	215	635	360
12	58	160	565	805	335	215	600	385
13	61	150	600	855	312	215	635	440
14	65	150	635	905	290	215	600	440
15	69	150	805	760	290	200	565	385
16	73	160	1,060	715	270	200	532	385
17	78	172	958	675	270	185	500	270
18	83	185	855	635	270	172	470	290
19	88	232	715	600	250	160	440	335
20	93	270	675	600	250	172	470	335
21	98	385	675	565	250	160	500	335
22	103	412	715	565	250	160	500	335
23	108	500	715	600	232	160	500	312
24	113	500	675	715	232	160	500	290
25	118	532	600	675	215	160	470	290
26	123	635	565	635	215	160	470	250
27	128	600	532	600	200	160	470	250
28	133	532	500	565	200	160	470	250
29	138	470	470	532	200	160	470	250
30	142	412	532	565	200	160	500	250
31	146	.....	675	.....	215	160	.....	250

NOTE.—Daily discharge determined from a rating curve well defined between 140 and 900 second-feet. Discharges estimated Mar. 1 to 31.

Monthly discharge of Badger Creek near Family, Mont., for 1911.

[Drainage area, 224 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a] 30	0.134	0.15	1,840	D.
February	.....	.....	[a] 25	.112	.12	1,390	D.
March	146	25	[a] 79.0	.353	.41	4,860	C.
April	635	132	273	1.22	1.36	16,200	B.
May	1,060	412	650	2.90	3.34	40,000	B.
June	1,120	532	748	3.34	3.72	44,500	B.
July	532	200	304	1.36	1.57	18,700	B.
August	232	160	190	.848	.98	11,700	B.
September	675	160	493	2.20	2.46	29,300	B.
October	500	250	356	1.59	1.83	21,900	B.
November	.....	.....	[a] 175	.781	.87	10,400	D.
December	.....	.....	[a] 75	.335	.39	4,610	D.
The year	1,120	.....	284	1.27	17.22	205,000	

[a] Estimated.

CUTBANK CREEK AT CUTBANK, MONT.

Location.—In the SW.¼ SW.¼ sec. 1, T. 33 N., R. 6 W., half a mile west of Cutbank, at the Great Northern Railway bridge, and 12 miles above the mouth of Two Medicine River.

Records available.—August 4, 1905, to December 31, 1911.

Drainage area.—971 square miles.

Gage.—Chain on left bank; moved upstream 200 yards August 31, 1911. New datum.

Channel.—Gravel; shifts in flood.

Discharge measurements.—At high stages made from a cable 100 yards below the gage; low-stage measurements made by wading.

Winter flow.—Affected by ice.

Diversions.—The intake of the Great Northern Railway's pumping station is located 100 feet below the gage; the average quantity pumped is about 14,000 gallons an hour for 18 hours a day, equivalent to a continuous flow of 0.4 second-foot.

Accuracy.—Results as a whole are good.

Discharge measurements of Cutbank Creek at Cutbank, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 6	B. E. Jones	([a])	15.6	Aug 3	John C. Beebe	3.52	208
Mar. 18	do	3.33	56	Aug. 31[b]	B. E. Jones	4.15	59
May 12	do	3.65	337	Sept. 24	W. A. Lamb	4.78	279
12	do	3.65	342	Oct. 17	B. E. Jones	4.41	122
June 13	do	4.00	709	Dec. 10	do	[a] 4.75	64

[a] Ice. [b] New gage established; new datum.

Daily gage height, in feet, of Cutbank Creek at Cutbank, Mont., for 1911.

[Chas. Ferres, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.56	3.51	3.76	3.94	3.30	4.15	4.58	4.40
2	.....	3.46	3.54	3.96	3.82	3.27	4.12	4.55	4.50
3	.....	3.36	3.54	4.15	3.74	3.42	4.12	4.60	4.62
4	.....	3.21	3.56	4.20	3.66	3.37	4.38	4.58	4.52
5	.....	3.21	3.56	4.15	3.64	3.34	5.25	4.52	4.48
6	.....	3.31	3.66	3.98	3.64	3.34	5.55	4.50	4.50
7	.....	3.26	3.86	3.88	3.59	3.47	5.55	4.50	4.30
8	.....	3.36	3.81	3.94	3.59	3.44	5.20	4.50	.....
9	.....	3.31	3.71	3.96	3.56	3.47	4.95	4.45	.....
10	.....	3.51	3.76	3.86	3.52	3.47	4.82	4.45	.....
11	.....	3.56	3.66	3.86	3.46	3.47	4.80	4.45	.....
12	.....	3.46	3.66	3.96	3.44	3.47	4.78	4.42	.....
13	.....	3.36	3.66	4.00	3.44	3.4	4.80	4.40	.....
14	.....	3.26	3.71	3.97	3.44	3.32	4.80	4.40	.....
15	.....	3.16	3.86	3.95	3.36	3.32	4.80	4.40	.....
16	.....	3.16	4.45	3.95	3.38	3.30	4.78	4.40	.....
17	3.36	3.24	4.70	3.85	3.43	3.23	4.72	4.40	.....
18	3.31	3.36	4.35	3.83	3.48	3.21	4.70	4.40	.....
19	3.41	3.38	4.10	3.80	3.51	3.19	4.62	4.40	.....
20	3.51	3.31	3.94	3.75	3.41	3.16	4.60	4.40	.....
21	3.54	3.36	3.86	3.75	3.35	3.11	4.60	4.38	.....
22	3.68	3.54	3.81	3.85	3.33	3.11	4.60	4.35	.....
23	3.76	3.61	3.86	3.85	3.33	3.13	4.70	4.35	.....
24	3.56	3.61	3.81	4.15	3.33	3.11	4.75	4.42	.....
25	.....	3.56	3.76	5.35	3.31	3.11	4.80	4.48	.....
26	.....	3.64	3.76	4.30	3.28	3.13	4.75	4.40	.....
27	4.05	3.66	3.76	4.00	3.23	3.16	4.75	4.50	.....
28	4.15	3.68	3.74	4.30	3.23	3.16	4.70	4.52	.....
29	3.66	3.66	3.68	3.95	3.23	3.11	4.68	4.40	.....
30	3.71	3.56	3.66	3.86	3.23	3.09	4.60	4.38	.....
31	3.71	.....	3.64	.....	3.25	3.03	.....	4.30	.....

NOTE.—Gage heights distorted by ice Nov. 1 to 7.

Daily discharge in second-feet of Cutbank Creek at Cutbank, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	290	260	423	630	120	58	182
2	.....	230	276	655	488	110	52	171
3	.....	182	276	910	402	170	52	190
4	.....	120	290	980	326	148	112	182
5	.....	120	290	910	309	136	621	160
6	.....	158	356	680	309	136	949	152
7	.....	138	530	557	268	195	949	152
8	.....	182	480	630	268	180	572	152
9	.....	158	394	655	249	195	379	135
10	.....	260	436	534	223	195	298	135
11	.....	290	356	534	190	195	286	135
12	.....	230	356	655	180	195	276	125
13	.....	182	326	705	180	160	286	118
14	.....	138	370	668	180	128	286	118
15	.....	102	534	642	144	128	286	118
16	.....	102	1,330	642	152	120	276	118
17	182	130	1,700	522	175	98	244	118
18	158	182	1,190	500	200	91	234	118
19	206	194	840	465	216	86	199	118
20	260	158	630	412	165	78	190	118
21	276	182	534	412	140	66	190	112
22	374	276	476	522	132	66	190	104
23	436	322	534	522	132	70	234	104
24	290	322	476	910	132	66	260	125
25	440	290	423	2,680	124	66	286	145
26	590	342	423	1,120	114	70	260	118
27	736	356	423	705	98	78	260	152
28	860	374	402	1,120	98	78	234	160
29	356	356	343	642	98	66	225	118
30	394	290	326	534	98	61	190	112
31	394	.....	309	.....	104	50	.....	90

NOTE.—Daily discharge determined as follows: Indirect method for shifting channel used to May 12; May 13 to Aug. 31, from a fairly well-defined curve; Sept. 1 to Nov. 7 (new location), from a poorly defined curve.

Monthly discharge of Cutbank Creek at Cutbank, Mont., for 1911.

[Drainage area, 971 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	16.0	0.016	0.02	984	D.
February	.....	.....	16.0	.016	.02	889	D.
March	860	.....	231	.238	.27	14,200	C.
April	374	102	222	.228	.25	13,200	C.
May	1,700	260	513	.528	.61	31,500	C.
June	2,680	412	728	.750	.84	43,300	C.
July	630	98	210	.216	.25	12,900	B.
August	195	50	116	.119	.14	7,130	B.
September	949	52	298	.307	.34	17,700	C.
October	190	90	134	.138	.16	8,240	C.
November	.....	.....	75	.077	.09	4,460	D.
December	.....	.....	50	.052	.06	3,070	D.
The year	2,680	.....	218	.224	3.05	158,000	

NOTE.—Means for January, February, November and December estimated; mean for period Mar. 1 to 16 estimated at 75 second-feet.

BIRCH CREEK NEAR DUPUYER, MONT.

Location.—In sec. 28, T. 29 N., R. 8 W., at Shield's ranch, 12 miles northwest of Dupuyer, Mont., and about 25 miles above the junction of Birch Creek with Two Medicine River.

Records available.—July 25, 1907, to December 31, 1911.

Drainage area.—155 square miles.

Gage.—A temporary staff gage was put in July 23, 1908, about 200 feet below the site of the original gage, which had been washed out by the high water of June, 1908. The temporary gage was used until October 1, 1908, when a permanent chain gage was installed at a point about one-fourth mile farther upstream.

Channel.—Shifts at high stages.

Discharge measurements.—Made from a car and cable three-fourths mile below the gage. At low stages measurements are made by wading just below the cable section.

Winter flow.—Affected by ice.

Diversions.—A number of ditches divert water for irrigation. The largest of these, owned by the Conrad Investment Co., diverts water about half a mile below the station.

Discharge measurements of Birch Creek near Dupuyer, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 23	C. S. Heidel	(a)	36	Aug. 5	R. Richards	4.70	148
Mar. 18	do	(a)	52	Oct. 6	Heideland Templeton	5.02	228
May 12	do	5.33	299	Oct. 10	C. S. Heidel	4.96	201
June 27	do	5.57	425	Dec. 1	R. M. Templeton	4.68	142

[a] Ice measurement. Not made at regular section.

Daily gage height, in feet, of Birch Creek near Dupuyer, Mont., for 1911.

[L. G. Kepple, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.39	4.95	5.90	5.40	4.65	4.45	5.10	4.70	4.70
2	4.39	4.95	6.35	5.25	4.80	4.45	5.10	4.70	.....
3	4.32	5.05	6.25	5.25	4.70	4.45	5.05	4.65	4.55
4	4.32	5.25	6.15	5.10	4.80	4.45	5.05	4.65	4.50
5	4.32	5.60	5.85	5.05	4.70	4.50	5.10	4.70	4.60
6	4.32	5.85	5.70	5.05	4.70	4.75	5.10	4.65	4.55
7	4.32	5.60	5.75	5.10	4.70	5.50	5.00	4.65	4.55
8	4.39	5.55	5.85	5.70	4.70	5.55	5.00	4.60	4.55
9	4.39	5.50	5.85	5.55	4.75	5.65	5.00	4.50	4.50
10	4.39	5.50	5.85	5.20	4.70	5.70	5.00	4.45	4.60
11	4.39	5.40	5.75	4.95	4.70	5.85	5.00	4.35	4.55
12	4.32	5.35	5.75	4.80	4.65	5.90	5.10	4.30	4.55
13	4.32	5.35	5.60	4.80	4.60	5.85	5.10	4.30	4.55
14	4.39	5.25	5.75	4.80	4.60	5.65	5.00	5.05	4.55
15	4.39	5.85	5.70	4.80	4.60	5.55	4.95	5.05	4.60
16	4.39	6.4	5.70	4.80	4.60	5.45	4.95	5.00	4.60
17	4.39	6.2	5.70	4.75	4.60	5.40	4.95	5.10	4.60
18	4.55	6.1	5.55	4.95	4.60	5.35	4.95	5.15	4.30
19	4.60	5.90	5.25	4.90	4.60	5.25	4.90	5.20	4.30
20	4.70	5.75	5.10	4.85	4.60	5.30	4.90	4.70	4.65
21	5.05	5.70	.....	4.80	4.55	5.25	4.85	4.65	4.60
22	5.20	5.60	.....	4.80	4.60	5.20	4.85	4.60	4.60
23	5.10	5.60	.....	4.90	4.55	5.20	4.90	4.60	4.65
24	5.05	5.55	.....	4.85	4.55	5.20	4.95	4.60	4.65
25	5.10	5.55	.....	4.75	4.55	5.20	4.80	4.60	4.25
26	5.35	5.50	5.55	4.75	4.55	5.15	4.95	4.60	5.00
27	5.50	5.35	5.55	4.70	4.55	5.20	4.70	4.60	5.00
28	5.40	5.25	5.55	4.70	4.50	5.15	4.70	4.60	5.00
29	5.10	5.35	5.50	4.70	4.50	5.15	4.70	4.60	5.25
30	5.05	5.40	5.50	4.70	4.50	5.15	4.70	4.60	5.20
31	.....	5.70	.....	4.70	4.45	.....	4.70	.....	5.55

NOTE.—Gage heights distorted by ice Nov. 14 to 19 and Dec. 17 to 31.

Daily discharge, in second-feet, of Birch Creek near Dupuyer, Mont., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	101	202	533	338	140	109	240	148	148
2	101	202	728	286	168	109	240	148	134
3	92	227	683	286	148	109	227	140	124
4	92	286	640	240	168	109	227	140	116
5	92	413	512	227	148	116	240	148	131
6	92	512	452	227	148	158	240	140	124
7	92	413	472	240	148	375	214	140	124
8	101	394	512	452	148	394	214	131	124
9	101	375	512	394	158	432	214	116	116
10	101	375	512	270	148	452	214	109	131
11	101	338	472	202	148	512	214	96	124
12	92	320	472	168	140	533	240	89	124
13	92	320	413	168	131	512	240	89	124
14	101	286	472	168	131	432	214	98	124
15	101	512	452	168	131	394	202	106	131
16	101	750	452	168	131	356	202	115	131
17	101	661	452	158	131	338	202	123	131
18	124	618	394	202	131	320	202	132	120
19	131	533	286	190	131	286	190	140	120
20	148	472	240	179	131	303	190	148	120
21	227	452	271	168	124	286	179	140	110
22	270	413	299	168	131	270	179	131	110
23	240	413	327	190	124	270	190	131	110
24	227	394	355	179	124	270	202	131	110
25	240	394	375	158	124	270	168	131	110
26	320	375	394	158	124	255	202	131	100
27	375	320	394	148	124	270	148	131	100
28	338	286	394	148	116	255	148	131	100
29	240	320	375	148	116	255	148	131	100
30	227	338	375	148	116	255	148	131	100
31	.....	452	.....	148	109	.....	148	.....	100

NOTE.—Daily discharge determined from a rating curve fairly well defined below 500 second-feet; discharge interpolated June 21 to 25, Nov. 14 to 19, and Dec. 2; discharge estimated Dec. 17 to 31.

Monthly discharge of Birch Creek near Dupuyer, Mont., for 1911.

[Drainage area, 155 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a] 50	0.323	0.37	3,070	D.
February	.....	.....	[a] 35	.226	.24	1,940	C.
March	.....	.....	[a] 55	.355	.41	3,380	C.
April	375	92	159	1.03	1.15	9,460	B.
May	750	202	399	2.57	2.96	24,500	B.
June	728	240	440	2.84	3.17	26,200	B.
July	452	148	209	1.35	1.56	12,900	B.
August	168	109	135	.871	1.00	8,300	B.
September	533	109	300	1.94	2.16	17,900	B.
October	240	148	201	1.30	1.50	12,400	B.
November	148	89	127	.819	.91	7,560	B.
December	148	.....	105	.677	.78	6,460	C.
The year	750	.....	186	1.20	16.21	134,000	

[a] Estimated.

DUPUYER CREEK AT DUPUYER, MONT.

Location.—In SW. ¼ SW. ¼ sec. 10, T. 28 N., R. 7 W., at the highway bridge in the town of Dupuyer, Mont.

Records available.—April 15, 1908, to December 31, 1911.

Drainage area.—Not measured.

Gage.—The original staff gage was nailed to the cribbing under the east end of the highway bridge. The gage was washed out July 28, 1909, and was replaced September 20, 1909, gage readings being reduced to the original datum. In the spring of 1909 a breakwater was constructed on the left (west) bank which deflected the water to the opposite site. A new gage was installed April 25, 1910, at the same site and the original datum, but owing to changes in the channel, the gage records for 1910 and 1911 are not directly comparable with those for earlier years.

Channel.—Shifts at high stages.

Discharge measurements.—Made from downstream side of highway bridge at high stages; low-stage measurements are made by wading.

Winter flow.—Affected by ice.

Accuracy.—Frequent measurements are necessary at this station to insure good results as conditions in the channel are unfavorable.

Discharge measurements of Dupuyer Creek at Dupuyer, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 23	C. S. Heidel	(a)	2.3	Oct. 6	Heidel and Templeton	1.5	88
Mar. 17	do	[a] 2.6	30	10	C. S. Heidel	1.45	75
May 12	do	1.10	43	Dec. 1	R. M. Templeton	[a] 2.6	55
June 27	do	1.5	88				
Aug. 5	R. Richards	1.38	62				

[a] Ice conditions.

Daily gage height, in feet, of Dupuyer Creek at Dupuyer, Mont., for 1911.

[John Pfeiffer, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.0	1.0	1.4	.....	1.3	1.2	1.6	1.3	2.6
2	1.0	1.0	1.5	1.5	1.6	1.2	1.5	1.3	2.6
3	.95	1.1	1.6	1.5	1.5	1.2	1.5	1.3	2.6
4	1.0	1.1	1.6	1.4	1.4	1.75	1.5	1.3	2.6
5	1.05	1.1	1.5	1.4	1.5	2.0	1.5	1.3	2.6
6	1.0	1.1	1.5	1.4	1.5	2.0	1.5	1.3	2.2
7	1.0	1.1	1.5	1.5	1.5	2.0	1.5	1.4	1.6
8	1.05	1.1	1.4	1.4	1.5	2.0	1.5	1.4	1.6
9	1.0	1.1	1.8	1.4	1.5	2.0	1.5	1.4	1.6
10	1.0	1.1	1.8	1.4	1.4	1.9	1.5	1.5	1.6
11	.9	1.1	1.7	1.4	1.4	1.9	1.5	1.5	1.7
12	.9	1.1	1.8	1.3	1.4	1.9	1.4	1.5	1.8
13	1.0	1.1	1.7	1.3	1.4	1.9	1.4	1.5	1.8
14	1.0	1.1	1.6	1.3	1.4	1.9	1.4	1.6	1.9
15	1.0	1.3	1.6	1.3	1.3	1.8	1.4	1.7	1.9
16	1.0	1.3	1.5	1.3	1.3	1.7	1.4	1.7	1.9
17	1.0	1.4	1.5	1.3	1.2	1.7	1.4	1.7	1.9
18	1.0	1.5	1.6	1.4	1.2	1.6	1.4	1.7	1.9
19	1.0	1.6	1.5	1.4	1.2	1.6	1.4	1.7	2.0
20	1.05	1.6	1.5	1.3	1.2	1.6	1.4	1.8	2.0
21	1.1	1.5	1.5	1.3	1.2	1.6	1.4	1.9	1.9
22	1.1	1.5	1.4	1.3	1.2	1.6	1.4	2.0	1.9
23	1.0	1.6	1.5	1.3	1.2	1.6	1.4	2.0	1.9
24	1.0	1.6	1.6	1.3	1.2	1.6	1.3	2.0	1.9
25	1.1	1.6	1.6	1.3	1.2	1.6	1.3	2.0	1.9
26	1.1	1.6	1.6	1.3	1.2	1.6	1.3	2.3	1.8
27	1.1	1.5	1.6	1.2	1.2	1.6	1.2	2.3	1.8
28	1.1	1.4	1.6	1.2	1.2	1.6	1.2	2.4	1.8
29	1.1	1.4	1.6	1.2	1.2	1.5	1.3	2.5	1.8
30	1.1	1.5	1.6	1.2	1.2	1.5	1.3	2.6	1.8
31	.....	1.4	.....	1.2	1.2	.....	1.3	.....	1.8

NOTE.—Gage heights, Nov. 7 to Dec. 31, distorted by ice.

Daily discharge, in second-feet, of Dupuyer Creek at Dupuyer, Mont., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	33	33	83	97	54	42	86	54
2	33	33	105	86	108	42	86	54
3	28	43	130	86	86	42	86	54
4	33	43	128	68	68	150	86	54
5	38	43	102	68	86	234	86	54
6	33	43	101	68	86	234	86	54
7	33	43	101	86	86	234	86	.....
8	38	42	79	68	86	234	86	.....
9	33	42	186	68	86	234	86	.....
10	33	42	185	68	68	199	86	.....
11	24	42	152	68	68	199	86	.....
12	24	42	183	54	68	199	68	.....
13	33	42	150	54	68	199	68	.....
14	33	42	121	54	68	199	68	.....
15	33	68	120	54	54	166	68	.....
16	33	68	96	54	54	135	68	.....
17	33	87	95	54	42	135	68	.....
18	33	110	118	68	42	108	68	.....
19	33	136	93	68	42	108	68	.....
20	38	136	92	54	42	108	68	.....
21	43	110	92	54	42	108	68	.....
22	43	110	72	54	42	108	68	.....
23	33	135	90	54	42	108	68	.....
24	33	135	112	54	42	108	54	.....
25	43	134	111	54	42	108	54	.....
26	43	134	110	54	42	108	54	.....
27	43	107	108	42	42	108	42	.....
28	43	84	108	42	42	108	42	.....
29	43	83	108	42	42	86	54	.....
30	43	106	108	42	42	86	54	.....
31	.....	83	.....	42	42	.....	54	.....

NOTE.—Daily discharge determined as follows: Apr. 1 to May 5, from rating curve fairly well defined; June 27 to Nov. 11, from curve fairly well defined between 5 and 100 second-feet. Indirect method for shifting channels used May 6 to June 26.

Monthly discharge of Dupuyer Creek at Dupuyer, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January			a 10	615	D.
February			a 5	278	D.
March			a 20	1,230	D.
April	43	24	35.4	2,110	C.
May	136	33	77.5	4,770	C.
June	186	72	115	6,840	C.
July	97	42	60.6	3,730	B.
August	108	42	58.9	3,620	B.
September	234	42	141	8,390	B.
October	86	42	70	4,300	B.
November			a 40	2,380	D.
December			a 20	1,230	D.
The year			54.4	39,500	

a Estimated.

DRY FORK OF MARIAS RIVER NEAR VALIER, MONT.

Location.—In the SW. ¼ sec. 36, T. 29 N., R. 5 W., about 9 miles southeast of Valier and 5 miles south of the dam of the Lake Francis Reservoir.

Records available.—March 19, 1911, to December 31, 1911.

Drainage area.—About 120 square miles.

Gages.—Bristol automatic and an inclined staff gage on the left bank. The Bristol gage has a range of 8 feet.

Channel.—Shifting; bed of stream composed of sand and gravel.

Discharge measurements.—At low and medium stages made by wading; during high stages it may be necessary to use floats.

Winter flow.—Affected by ice.

Diversions.—Appropriations amounting to nearly 1,200 second-feet have been filed on Dry Fork and its branches.

Discharge measurements of Dry Fork of Marias River near Valier, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 16	C. S. Heidel	a 2.60	32	Sept. 7	R. M. Templeton	3.30	b 228
19	do	a 3.30	153	Oct. 5	C. S. Heidel	2.60	58
May 11	do	1.47	0.99	9	do	2.20	17.9
June 27	do	1.74	9.8	9	do	2.20	18.7
Aug. 5	R. Richards	1.74	10.3	Nov. 24	R. M. Templeton	a 2.50	28.0

a Ice present. b Float measurement.

Daily gage height, in feet, of Dry Fork of Marias River near Valier, Mont., for 1911.

[W. R. Hunt, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.9	1.6	.....	1.6	0.9	1.15	2.2	2.2	2.2
2	.....	1.9	1.6	.....	1.9	1.7	1.15	2.2	2.2	2.2
3	.....	.....	1.6	.....	1.9	2.75	1.15	3.2	2.1	2.3
4	.....	.....	1.6	1.5	1.65	2.4	1.6	3.2	2.1	2.3
5	.....	.....	1.6	1.5	1.55	1.9	3.8	2.9	2.4	2.2
6	.....	.....	1.6	1.6	1.4	1.7	4.3	2.4	2.2	2.2
7	.....	.....	1.6	1.7	1.3	1.9	3.3	2.2	2.2	2.2
8	.....	.....	1.6	1.9	1.2	2.0	3.8	2.2	2.3	2.2
9	.....	1.8	1.6	1.8	1.15	1.9	2.8	2.2	2.1	2.2
10	.....	1.8	1.6	1.6	1.1	2.0	2.6	2.2	2.2	2.2
11	.....	1.7	1.47	1.5	1.0	1.9	2.5	2.1	2.2	2.2
12	.....	1.8	.....	1.5	.9	1.8	2.4	2.1	2.2	2.2
13	.....	1.8	.....	1.5	.9	1.6	2.4	2.2	2.3	2.2
14	.....	1.7	.....	1.5	.9	1.55	2.35	2.2	2.2	2.2
15	.....	1.7	4.0	1.5	.9	1.5	2.3	2.2	2.2	2.2
16	2.6	1.6	.....	1.5	.9	1.45	2.25	2.2	2.2	2.2
17	.....	1.6	2.6	1.5	.9	1.4	2.2	2.2	2.2	2.2
18	.....	1.6	.....	1.5	.9	1.35	2.2	2.1	2.2	2.2
19	3.3	1.6	.....	1.4	.9	1.3	2.2	2.1	2.2	2.2
20	3.1	1.5	.....	1.3	.9	1.25	2.2	2.2	2.2	2.2
21	2.6	1.5	2.0	1.0	.9	1.25	2.2	2.3	2.2	2.3
22	2.1	1.55	.....	1.0	.9	1.25	2.2	2.3	2.2	2.3
23	2.0	1.55	.....	1.0	.9	1.25	2.3	2.2	2.2	2.3
24	2.4	1.6	.....	1.0	.9	1.2	2.4	2.1	2.2	2.2
25	2.0	1.6	.....	2.0	.9	1.2	2.4	2.1	2.3	2.2
26	2.0	1.6	1.9	1.8	.9	1.2	2.35	2.1	2.2	2.2
27	1.8	1.6	.....	1.7	.9	1.2	2.3	2.2	2.2	2.2
28	1.8	1.6	2.1	1.65	.9	1.2	2.3	2.1	2.3	2.1
29	1.8	1.6	.....	1.55	.9	1.2	2.2	2.3	2.3	2.1
30	1.8	1.6	.....	1.5	.9	1.2	2.2	2.2	2.2	2.1
31	1.9	.....	.....	.....	.9	1.2	.....	2.0	.....	.....

NOTE.—Gage heights distorted by ice Mar. 16 to 22 and Nov. 5 to Dec. 30.

Daily discharge, in second-feet, of Dry Fork of Marias River near Valier, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	24	3.8	20	3.8	0.0	0.0	19	19
2	.....	24	3.8	14	24	8	.0	19	19
3	.....	23	3.8	8	24	132	.0	139	12
4	.....	22	3.8	1.3	5.9	83	3.8	139	12
5	.....	21	3.8	1.3	2.6	24	326	97	12
6	.....	19	3.8	3.8	.0	8	429	36	12
7	.....	18	3.8	8	.0	24	230	19	12
8	.....	16	3.8	24	.0	35	326	19	12
9	.....	15	3.8	15	.0	24	141	19	12
10	.....	15	3.8	3.8	.0	35	110	19	19
11	.....	8	.9	1.3	.0	24	46	12	19
12	.....	15	1.0	1.3	.0	15	36	12	19
13	.....	15	1.0	1.3	.0	3.8	36	19	19
14	.....	8	50	1.3	.0	2.6	32	19	19
15	.....	8	366	1.3	.0	1.3	27	19	20
16	32	3.8	238	1.3	.0	.6	23	19	20
17	72	3.8	110	1.3	.0	.0	19	19	21
18	112	3.8	91	1.3	.0	.0	19	12	22
19	153	3.8	72	.0	.0	.0	19	12	23
20	134	1.3	53	.0	.0	.0	19	19	24
21	84	1.3	35	.0	.0	.0	19	27	25
22	35	2.6	33	.0	.0	.0	19	27	26
23	35	2.6	31	.0	.0	.0	27	19	27
24	83	3.8	28	.0	.0	.0	36	12	28
25	35	3.8	26	35	.0	.0	36	12	25
26	35	3.8	24	15	.0	.0	32	12	20
27	15	3.8	35	8	.0	.0	27	19	20
28	15	3.8	46	5.9	.0	.0	27	12	15
29	15	3.8	40	2.6	.0	.0	19	27	15
30	15	3.8	33	1.3	.0	.0	19	19	10
31	24	.....	27	.....	.0	.0	.....	6.5	.....

NOTE.—Daily discharge determined from two rating curves: Mar. 23 to Sept. 10, well-defined, and Sept. 11 to Nov. 30, fairly well defined. Discharge estimated Mar. 16 to 22 and Nov. 5 to 30. Discharge interpolated on other days for which gage heights are missing.

Monthly discharge of Dry Fork of Marias River near Valier, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March 16-31	153	15.0	55.9	1,770	C.
April	24	1.3	10.0	595	B.
May	366	0.9	44.5	2,740	B.
June	35	0	5.91	352	B.
July	24	0	1.95	120	B.
August	133	0	13.6	836	B.
September	429	0	70.1	4,170	C.
October	139	6.5	28.4	1,750	C.
November	28	10	18.6	1,110	D.
December			10	615	D.
The period				14,100	

NOTE.—Mean for December estimated.

TETON RIVER AT STRABANE,[1] MONT.

Location.—In the SE. ¼ NE. ¼ sec. 35, T. 25 N., R 7 W., 1 mile north of Peeble's ranch, 16 miles above Chouteau, Mont., at Strabane post office.

Records available.—November 26, 1904, to December 31, 1906; January 16, 1908, to December 31, 1911.

Drainage area.—140 square miles.

Gage.—The original gage was spiked to a post on the left bank about 40 feet above the bend of Kroff's irrigation ditch. On March 9, 1905, it was moved by the observer to a point 250 feet upstream to avoid the effect of the dam erected at the head of the ditch below. On May 8, 1905, the gage was referred to the bench marks and it was found that the datum had been raised 0.7 foot in moving; the difference between the level of the water surface at the old site and that at the new was 0.20 foot; on May 8, 1906, the gage was again moved 1½ miles upstream to Mr. Bjornstad's ranch and set at an entirely different datum. The station was discontinued during 1907, and when it was reestablished in 1908 a standard chain gage was installed on the left bank. On March 23, 1911, a new station was established one-half mile downstream from old gage.

Channel.—Shifts at high stages; current swift.

Discharge measurements.—At flood stages, made from cable one-fourth mile above the gage; at low stages, by wading at various sections.

Winter flow.—Not affected by ice.

Diversions and storage.—Practically no water is diverted above the station, but the ordinary flow below the station is appropriated and used for irrigation. An irrigation project now being constructed under the Carey Act will store the flood water of Teton River in the reservoir about 5 miles north of the gaging section. The capacity of the reservoir is 90,000 acre-feet, and it can be increased to 210,000 acre-feet by raising the top of the dam 20 feet. The reservoir will serve 120,000 acres of land on the north side of the river. The water will be diverted half a mile above the gage.

Accuracy.—Accurate determination of discharge during high stages is difficult because of the shifting channel.

[1] Station was described in earlier reports as "Teton River near Belleview, Mont." Post office was moved from Belleview to Strabane in 1910.

Discharge measurements of Teton River at Strabane, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 21[a]	A. S. Heidel	.....	24	June 21	W. A. Lamb	3.90	177
Mar. 23	do	3.05	46	Aug. 8	R. Richards	3.55	128
May 13	B. E. Jones	3.96	198	Oct. 19	B. E. Jones	3.48	110
May 17	do	4.66	518				

[a] Ice conditions.

Daily gage height, in feet, of Teton River at Strabane, Mont., for 1911.

[Belle Peebles, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.05	3.40	4.30	3.80	3.75	3.30	3.50	3.45	3.20
2	.....	3.05	3.40	4.40	3.80	3.75	3.30	3.50	3.45	3.20
3	.....	3.00	3.45	4.60	3.70	3.75	3.35	3.45	3.50	3.20
4	.....	2.95	3.45	4.80	3.70	3.80	3.40	3.45	3.50	3.15
5	.....	2.95	3.90	4.50	3.65	3.75	3.40	3.45	3.45	3.15
6	.....	2.95	4.10	4.35	3.65	3.70	3.40	3.50	3.45	3.15
7	.....	2.90	4.10	3.30	3.65	3.60	3.45	3.50	3.40	3.15
8	.....	2.95	4.15	4.30	3.65	3.55	3.45	3.55	3.40	3.10
9	.....	2.95	4.10	4.40	3.65	3.50	3.45	3.55	3.35	3.05
10	.....	3.00	4.00	4.40	3.85	3.50	3.50	3.50	3.35	3.05
11	.....	3.00	4.00	4.50	3.85	3.50	3.50	3.50	3.30	3.05
12	.....	3.00	3.95	4.40	3.90	3.40	3.50	3.45	3.30	3.10
13	.....	2.95	4.00	4.30	3.90	3.45	3.55	3.45	3.20	3.15
14	.....	2.95	4.30	4.20	3.85	3.45	3.55	3.45	3.20	3.15
15	.....	2.95	4.60	4.35	3.85	3.40	3.50	3.45	3.15	3.15
16	.....	2.90	5.00	4.30	3.80	3.40	3.50	3.45	3.05	3.10
17	.....	2.90	4.70	4.32	3.75	3.45	3.50	3.45	3.05	3.10
18	.....	2.90	4.50	4.25	3.75	3.45	3.55	3.50	3.10	3.10
19	.....	3.00	4.40	4.20	3.75	3.45	3.55	3.50	3.20	3.10
20	.....	3.00	4.30	3.95	3.70	3.40	3.50	3.50	3.30	3.05
21	.....	3.05	4.30	3.90	3.70	3.40	3.50	3.55	3.30	3.05
22	.....	3.05	4.30	3.95	3.70	3.35	3.55	3.60	3.30	3.05
23	3.05	3.10	4.20	4.00	3.65	3.35	3.55	3.60	3.40	3.05
24	3.05	3.25	4.25	4.00	3.65	3.35	3.60	3.60	3.45	3.00
25	3.10	3.22	4.25	4.05	3.65	3.30	3.55	3.60	3.45	3.00
26	3.10	3.55	4.25	4.00	3.60	3.30	3.55	3.60	3.40	3.00
27	3.08	3.55	4.25	3.95	3.60	3.25	3.50	3.55	3.30	3.00
28	3.00	3.55	4.20	3.92	3.65	3.25	3.50	3.55	3.30	3.00
29	3.00	3.45	4.11	3.90	3.65	3.25	3.45	3.55	3.25	2.95
30	3.00	3.45	4.05	3.80	3.70	3.30	3.45	3.50	3.25	2.90
31	3.05	.....	4.15	.....	3.70	3.30	.....	3.50	.....	2.90

Daily discharge, in second-feet, of Teton River at Strabane, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	47	96	315	168	158	80	112	104	66
2	.....	47	96	365	168	158	80	112	104	66
3	.....	41	104	490	148	158	88	104	112	66
4	.....	36	104	620	148	168	96	104	112	60
5	.....	36	190	425	139	158	96	104	104	60
6	.....	36	237	340	139	148	96	112	104	60
7	.....	30	237	315	139	130	104	112	96	60
8	.....	36	254	315	139	121	104	121	96	53
9	.....	36	237	365	139	112	104	121	88	47
10	.....	41	212	365	179	112	112	112	88	47
11	.....	41	212	425	179	112	112	112	80	47
12	.....	41	201	365	190	96	112	104	80	53
13	.....	36	212	315	190	104	121	104	66	60
14	.....	36	315	272	179	104	121	104	66	60
15	.....	36	490	340	179	96	112	104	60	60
16	.....	30	750	315	168	96	112	104	47	53
17	.....	30	555	325	158	104	112	104	47	53
18	.....	30	425	294	158	104	121	112	53	53
19	.....	41	365	272	158	104	121	112	66	53
20	.....	41	315	201	148	96	112	112	80	47
21	.....	47	315	190	148	96	112	121	80	47
22	.....	47	315	201	148	88	121	130	80	47
23	47	53	272	212	139	88	121	130	96	47
24	47	73	294	212	139	88	130	130	104	41
25	53	69	294	224	139	80	121	130	104	41
26	53	121	294	212	130	80	121	130	96	41
27	51.	121	294	201	130	73	112	121	80	41
28	41	121	272	194	139	73	112	121	80	41
29	41	104	240	190	139	73	104	121	73	36
30	41	104	224	168	148	80	104	112	73	30
31	47	.....	254	.....	148	80	.....	112	.....	30

NOTE.—Daily discharge determined from a rating curve fairly well defined below 215 second-feet.

Monthly discharge of Teton River at Strabane, Mont., for 1911.

[Drainage area, 140 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a] 35	0.250	0.29	2,150	D.
February	.....	.....	[a] 30	.214	.22	1,670	D.
March	.....	.....	38.4	.274	.32	2,360	C.
April	121	30	53.6	.383	.43	3,190	B.
May	750	96	280	2.00	2.31	17,200	B.
June	620	168	301	2.15	2.40	17,900	B.
July	190	130	154	1.10	1.27	9,470	B.
August	168	73	108	.771	.89	6,640	B.
September	130	80	109	.779	.87	6,490	B.
October	130	104	114	.814	.94	7,010	B.
November	112	47	84.0	.600	.67	5,000	B.
December	66	30	50.5	.361	.42	3,110	B.
The year	.....	.....	113	.807	11.03	82,200	

[a] Estimated.

NOTE.—Mean discharge for period Mar. 1 to 22, estimated at 35 second-feet.

DEEP CREEK NEAR CHOTEAU, MONT.

Location.—At Hugh Robinson's ranch, in the SW. ¼ NW. ¼ sec. 15, T. 15 N., R. 5 W., 5 miles southwest of Choteau, Mont.

Records available.—March 24, 1911, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Standard chain on right bank.

Channel.—Clean and fairly permanent; bed composed of gravel; gravel bar about 50 feet below the gage forms the control.

Discharge measurements.—Made by wading.

Winter flow.—Affected by ice.

Diversions.—A few small ditches divert water from the creek.

Accuracy.—Records fair.

Discharge measurements of Deep Creek near Choteau, Mont., in 1910—11.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
1910.		*Feet.*	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 2	U. S. R. S. Engineers.	1.10	28.7	May 14	B. E. Jones	5.91	84
10	do	1.10	25.1	18	do	6.60	259
17	do	1.05	24.4	June 21	W. A. Lamb	6.10	117
				Aug. 7	R. Richards	6.04	95
1911.				Oct. 19	B. E. Jones	5.70	42
Mar. 24[a]	J. C. Beebe	5.87	76	25	W. A. Lamb	5.70	42

[a] New gage—new datum.

Daily gage height, in feet, of Deep Creek near Choteau, Mont., for 1911.

[Hugh Robinson, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		5.7	5.8	6.1	6.35	5.8	5.6	5.7	5.6
2		5.7	5.7	6.2	6.15	5.8	5.5	5.75	5.55
3		5.7	5.7	6.3	6.2	6.0	5.6	5.85	5.55
4		5.6	5.8	6.4	6.15	6.0	5.8	5.75	5.55
5		5.6	5.8	6.4	6.0	6.05	6.3	5.8	5.7
6		5.6	6.0	6.3	6.05	6.3	6.3	5.7	5.75
7		5.6	6.0	6.3	5.9	6.1	6.3	5.7	5.7
8		5.7	6.0	6.4	6.0	6.1	6.0	5.7	5.7
9		5.7	6.0	6.5	6.0	6.05	6.0	5.7	5.9
10		5.7	6.0	6.3	5.8	5.9	5.85	5.8	6.0
11		5.7	6.0	6.4	5.8	6.0	5.9	5.65	5.9
12		5.7	5.9	6.2	5.8	5.8	5.8	5.65	
13		5.7	5.9	6.3	5.8	5.8	5.75	5.65	
14		5.7	5.8	7.0	5.8	5.8	5.75	5.65	
15		5.6	6.6	6.5	5.8	5.8	5.7	5.75	
16		5.6	7.3	6.7	6.4	5.7	5.8	5.65	
17		5.7	6.9	6.3	6.1	5.8	5.7	5.65	
18		5.7	6.6	6.2	6.0	5.65	5.8	5.65	
19		5.7	6.4	6.1	5.9	5.75	5.7	5.65	
20		5.6	6.3	6.1	5.95	5.6	5.8	5.75	
21		5.6	6.3	6.1	5.9	5.7	5.7	5.65	
22		5.7	6.3	6.15	5.8	5.6	5.8	5.65	
23		5.7	6.2	6.2	5.9	5.7	5.7	5.65	
24	5.9	5.7	6.3	6.4	5.8	5.6	5.75	5.7	
25	5.8	5.8	6.2	6.35	5.8	5.6	5.75	5.75	
26	5.8	5.8	6.3	6.2	5.8	5.6	5.75	5.6	
27	5.7	5.8	6.4	6.1	5.8	5.7	5.8	5.65	
28	5.7	5.9	6.3	6.15	5.7	5.6	5.7	5.65	
29	5.7	5.8	6.2	6.05	5.8	5.7	5.7	5.7	
30	5.7	5.8	6.1	6.2	5.7	5.6	5.7	5.75	
31	5.7		6.1		5.75	5.6		5.65	

NOTE.—Gage heights, Nov. 9 to 11, distorted by ice.

Daily discharge, in second-feet, of Deep Creek near Choteau, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	43	58	118	176	58	30	43	30
2	.....	43	43	142	130	58	18	50	24
3	.....	43	43	162	142	96	30	67	24
4	.....	30	58	196	130	96	58	50	24
5	.....	30	58	196	96	107	162	58	43
6	.....	30	96	162	107	162	162	43	50
7	.....	30	96	162	76	118	162	43	43
8	.....	43	96	196	96	118	96	43	43
9	.....	43	96	227	96	107	96	43	.....
10	.....	43	96	162	58	76	67	58	.....
11	.....	43	96	196	58	96	76	36	.....
12	.....	43	76	142	58	58	58	36	.....
13	.....	43	76	162	58	58	50	36	.....
14	.....	43	58	425	58	58	50	36	.....
15	.....	30	260	227	58	58	43	50	.....
16	.....	30	582	296	196	43	58	36	.....
17	.....	43	378	162	118	58	43	36	.....
18	.....	43	260	142	96	36	58	36	.....
19	.....	43	196	118	76	50	43	36	.....
20	.....	30	162	118	86	30	58	50	.....
21	.....	30	162	118	76	43	43	36	.....
22	.....	43	162	130	58	30	58	36	.....
23	.....	43	142	142	76	43	43	36	.....
24	76	43	162	196	58	30	50	43	.....
25	58	58	142	176	58	30	50	50	.....
26	58	58	162	142	58	30	50	30	.....
27	43	58	196	118	58	43	58	36	.....
28	43	76	162	130	43	30	43	36	.....
29	43	58	142	107	58	43	43	43	.....
30	43	58	118	142	43	30	43	50	.....
31	43	.....	118	.....	50	30	.....	36	.....

NOTE.—Daily discharge determined from a well-defined curve.

Monthly discharge of Deep Creek near Choteau, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March 24-31	76	43	51	810	B.
April	76	30	43.1	2,560	B.
May	582	43	147	9,040	B.
June	425	107	170	10,100	B.
July	196	43	84.0	5,160	B.
August	162	30	62.0	3,810	B.
September	162	18	63.3	3,770	B.
October	67	30	42.5	2,610	B.
November	50	.....	27.7	1,650	C.
December	.....	.....	[a] 15.0	922	D.
The period	.....	.....	.....	40,400	

[a] Estimated.

NOTE.—Mean discharge for period Nov. 12 to 30 estimated at 25 second-feet.

MUSSELSHELL RIVER BASIN.

NORTH FORK OF MUSSELSHELL RIVER NEAR DELPINE, MONT.

Location.—In the SE. ¼ SW. ¼ sec. 35, T. 10 N., R. 9 E., at a proposed dam site 3 miles above Delpine, Mont., and about 16 miles northeast of Martinsdale, Mont.

Records available.—May 19, 1909, to December 31, 1911.

Drainage area.—Not measured.

Gage.—A staff near left bank nailed to foot log which spans the stream; datum unchanged.

Channel.—Gravel.

Discharge measurements.—Made from foot log or by wading.

Diversions and storage.—Several ditches take water for irrigation. The drainage area above the station affords an excellent reservoir site; 28,000 acre-feet of water may be stored with a 130-foot dam at the station.

Discharge measurements of North Fork of Musselshell River near Delpine, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 16	C. S. Heidel	Ice	7.8	June 5	C. S. Heidel	1.89	25
Apr. 9	do	1.76	18.9	Aug. 3	do	1.57	9.5
May 5	do	1.77	17.9	Oct. 28	do	1.54	7.9

Daily gage height, in feet, of North Fork of Musselshell River near Delpine, Mont., for 1911.

[Thomas Harbor, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1		2.05	1.71	1.97	1.64	1.52	1.43	1.34
2		1.80	1.72	1.81	1.62	1.66	1.43	1.34
3		1.75	1.70	1.77	1.62	1.57	1.43	1.39
4		1.75	1.70	1.91		1.62	1.43	1.39
5		1.80	1.70	1.89	1.62	1.57	1.41	1.39
6		1.80	1.71	1.81	1.60		1.38	1.39
7		1.70	1.78	1.88	1,57	1.57	1.38	1.39
8		1.68	1.78	1.96	1.55	1.57	1.38	1.39
9		1.76	1.80	1.99	1.52	1.55	1.36	1.39
10		1.71	1.80	1.83	1.52	1.52	1.33	1.39
11		1.70	1.75	1.86	1.52	1.53	1.33	1.39
12		1.73	1.78	1.82	1.52	1.50	1.33	1.39
13		1.71	1.76	1.83	1.52	1.50	1.34	1.41
14		1.70	1.75	1.86	1.47	1.50	1.33	1.41
15		1.60	1.90	1.91	1.52	1.48	1.33	1.39
16	1.60	1.62	1.75	1.88	1.55	1.46	1.33	1.39
17	1.60	1.65	1.78	1.81	1.57	1.46	1.33	1.39
18	1.40	1.68	1.76	1.76	1.57	1.43	1.33	1.39
19	1.85	1.65	1.75	1.77	1.57	1.43	1.33	1.39
20	2.07	1.68	1.66	1.76	1.57	1.43	1.33	1.39
21	2.15	1.71	1.69	1.69	1.59	1.43	1.34	
22	2.30	1.74	1.71	1.69	1.57	1.43		
23	2.45	1.71	1.71	1.61	1.57	1.43	1.34	
24	2.25	1.80	1.91	1.61	1.57	1.44	1.34	
25	2.20	1.72	2.09		1.55	1.45	1.34	
26	2.15	1.81	2.04	1.66	1.49	1.44		
27	1.73	1.90	1.98	1.66	1.49	1.43	1.34	
28	1.70	1.74	1.81	1.66	1.52	1.44	1.34	
29	1.75	1.72	1.84	1.66	1.52	1.43	1.34	
30	2.05	1.70	1.79	1.69	1.52	1.43	1.34	
31	2.10		1.77		1.52	1.43		

Daily discharge, in second-feet, of North Fork of Musselshell River near Delpine, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	36	16	30	12	7.6	5.6	4.1
2	.....	20	16	21	11	13	5.6	4.1
3	.....	18	15	18	11	9.1	5.6	4.8
4	.....	18	15	27	11	11	5.6	4.8
5	.....	20	15	25	11	9.1	5.2	4.8
6	.....	20	16	21	10	9.1	4.7	4.8
7	.....	15	19	25	9.1	9.1	4.7	4.8
8	.....	14	19	30	8.5	9.1	4.7	4.8
9	.....	18	20	31	7.6	8.5	4.4	4.8
10	.....	16	20	22	7.6	7.6	4.0	4.8
11	.....	15	18	24	7.6	7.9	4.0	4.8
12	.....	16	19	21	7.6	7	4.0	4.8
13	.....	16	18	22	7.6	7	4.1	5.2
14	.....	15	18	24	6.4	7	4.0	5.2
15	.....	10	26	27	7.6	6.6	4.0	4.8
16	10	11	18	25	8.5	6.2	4.0	4.8
17	10	12	19	21	9.1	6.2	4.0	4.8
18	5	14	18	18	9.1	5.6	4.0	4.8
19	23	12	18	18	9.1	5.6	4.0	4.8
20	38	14	13	18	9.1	5.6	4.0	4.8
21	44	16	14	14	9.7	5.6	4.1	.....
22	57	17	16	14	9.1	5.6	4.1	.....
23	71	16	16	10	9.1	5.6	4.1	.....
24	52	20	27	10	9.1	5.8	4.1	.....
25	48	16	39	12	8.5	6.0	4.1	.....
26	44	21	35	13	6.8	5.8	4.1	.....
27	16	26	31	13	6.8	5.6	4.1	.....
28	15	17	21	13	7.6	5.8	4.1	.....
29	18	16	22	13	7.6	5.6	4.1	.....
30	36	15	20	14	7.6	5.6	4.1	.....
31	40	.....	18	.....	7.6	5.6	.....	.....

NOTE.—Daily discharge determined from a rating curve fairly well defined below 32 second-feet. Discharge interpolated for days for which gage heights are missing.

Monthly discharge of North Fork of Musselshell River near Delpine, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	7.0	430	D.
February	.....	.....	6.0	333	D.
March	71	.....	17.5	1,080	C.
April	36	10	17.0	1,010	B.
May	39	13	19.8	1,220	B.
June	31	10	19.8	1,180	B.
July	12	6.4	8.71	536	B.
August	13	5.6	7.11	437	B.
September	5.6	4.0	4.37	260	B.
October	5.2	4.1	4.67	287	C.
November	.....	.....	4.5	268	D.
December	.....	.....	4.5	277	D.
The year	.....	.....	10.1	7,320	

NOTE.—Means for January, February, November, and December estimated. Discharge Mar. 1 to 15 estimated at 5 second-feet per day, and Oct. 21 to 31 at 4.5 second-feet.

NORTH FORK OF MUSSELSHELL RIVER NEAR MARTINSDALE, MONT.

Location.—In sec. 6, T. 8 N., R. 12 E., half a mile above the junction of the North and South Forks, at the ranch of Martin J. Settle, 4 miles north of Martinsdale.

Records available.—May 10, 1907, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Chain attached to left bank just above observer's private wagon bridge; datum unchanged.

Channel.—Composed of gravel; may shift somewhat during high-water, as current is swift.

Discharge measurements.—Made from the private wagon bridge or by wading.

Winter flow.—Affected by ice.

Storage.—Under a Carey Act project the water of the North Fork, which is practically all appropriated, will be stored at a point about 20 miles above the station and used to irrigate land between Martinsdale and Harlowton.

Accuracy.—Records obtained during open season are very good.

Discharge measurements of North Fork of Musselshell River near Martinsdale, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 17	C. S. Heidel	(a)	18.4	June 4	C. S. Heidel	4.28	152
Apr. 8	do	3.50	37	July 28	do	3.15	9.4
May 6	do	3.78	74	Oct. 27	do	3.66	55

a Ice conditions.

Daily gage height, in feet, of North Fork of Musselshell River near Martinsdale, Mont., for 1911.

[Martin J. Settle, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		3.6	3.7	4.4	3.45	3.3	3.25	3.35	3.6
2		3.7	3.7	4.8	3.5	3.45	3.25	3.35	3.6
3		3.6	3.7	4.5	3.45	3.45	3.3	3.35	3.55
4		3.6	3.7	4.4	3.4	3.45	3.3	3.35	3.45
5		3.5	3.8	4.25	3.4	3.65	3.3	3.4	3.4
6		3.5	3.8	4.15	3.4	3.9	3.3	3.4	3.45
7		3.5	3.8	4.1	3.35	3.75	3.3	3.35	3.45
8		3.5	3.8	4.0	3.35	3.55	3.3	3.35	3.45
9		3.6	3.7	4.0	3.35	3.5	3.3	3.35	3.65
10		3.65	3.7	3.85	3.3	3.65	3.25	3.35	3.9
11		3.65	3.6	3.85	3.3	3.5	3.25	3.35	4.2
12		3.5	3.6	3.8	3.25	3.45	3.25	3.35	3.9
13		3.5	3.6	3.75	3.2	3.4	3.3	3.35	3.85
14		3.5	3.6	3.75	3.5	3.35	3.25	3.35	3.9
15		3.5	3.7	3.7	3.5	3.4	3.25	3.35	4.5
16		3.6	4.0	3.85	3.1	3.4	3.25	3.35	4.5
17		3.65	3.8	3.7	3.25	3.4	3.25	3.35	3.95
18		3.65	3.8	3.7	3.25	3.35	3.25	3.35	
19		3.6	3.75	3.65	3.25	3.35	3.3	3.4	
20	3.9	3.6	3.7	3.6	3.15	3.3	3.3	3.4	
21	4.0	3.7	3.65	3.65	3.2	3.3	3.3	3.4	
22	3.9	3.75	3.6	3.7	3.25	3.3	3.3	3.4	
23	3.9	3.7	3.65	3.6	3.25	3.35	3.35	3.4	
24	4.0	3.65	4.0	3.45	3.2	3.35	3.35	3.4	
25	3.8	3.7	4.65	3.4	3.15	3.35	3.35	3.45	
26	3.6	3.7	4.6	3.4	3.15	3.35	3.35	3.55	
27	3.6	3.8	4.45	3.4	3.15	3.35	3.35	3.55	
28	3.4	3.9	4.3	3.45	3.15	3.3	3.35	3.55	
29	3.0	3.8	4.3	3.5	3.1	3.3	3.35	3.7	
30	3.7	3.7	4.3	3.45	3.45	3.3	3.35	3.45	
31	3.7		4.25		3.3	3.25		3.45	

NOTE.—Gage heights Nov. 9 to 17 distorted by ice.

Daily discharge, in second-feet, of North Fork of Musselshell River near Martinsdale, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	48	60	173	32	19	16	23	48
2	.....	60	60	248	37	32	16	23	48
3	.....	48	60	191	32	32	19	23	42
4	.....	48	60	173	27	32	19	23	32
5	.....	37	74	146	27	54	19	27	27
6	.....	37	74	129	27	89	19	27	32
7	.....	37	74	121	23	67	19	23	32
8	.....	37	74	105	23	42	19	23	32
9	.....	48	60	105	23	37	19	23	.....
10	.....	54	60	82	19	54	16	23	.....
11	.....	54	48	82	19	37	16	23	.....
12	.....	37	48	74	16	32	16	23	.....
13	.....	37	48	67	12	27	19	23	.....
14	.....	37	48	67	37	23	16	23	.....
15	.....	37	60	60	37	27	16	23	.....
16	.....	48	105	82	7	27	16	23	.....
17	.....	54	74	60	16	27	16	23	.....
18	.....	54	74	60	16	23	16	23	.....
19	.....	48	67	54	16	23	19	27	.....
20	89	48	60	48	9.5	19	19	27	.....
21	105	60	54	54	12	19	19	27	.....
22	89	67	48	60	16	19	19	27	.....
23	89	60	54	48	16	23	23	27	.....
24	105	54	105	32	12	23	23	27	.....
25	74	60	218	27	9.5	23	23	32	.....
26	48	60	209	27	9.5	23	23	42	.....
27	48	74	182	27	9.5	23	23	42	.....
28	27	89	155	32	9.5	19	23	42	.....
29	3	74	155	37	7	19	23	60	.....
30	60	60	155	32	32	19	23	32	.....
31	60	.....	146	.....	19	16	.....	32	.....

NOTE.—Daily discharge determined from a fairly well defined rating curve.

Monthly discharge of North Fork of Musselshell River near Martinsdale, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	20	1,230	D.
February	.....	.....	18	1,000	D.
March	105	.....	41.0	2,520	C.
April	89	37	52.2	3,110	B.
May	218	48	89.3	5,490	B.
June	248	27	83.4	4,960	B.
July	37	7	19.6	1,210	B.
August	89	16	30.6	1,880	B.
September	23	16	19.1	1,140	B.
October	60	23	27.9	1,720	B.
November	.....	.....	28.1	1,670	C.
December	.....	.....	20	1,230	D
The year	248	.....	37.5	27,200	

NOTE.—Means for January, February, and December estimated; mean for period Mar. 1 to 19 estimated at 25 second-feet; mean for period Nov. 9 to 30 estimated at 25 second-feet.

MUSSELSHELL RIVER AT HARLOWTON, MONT.

Location.—In sec. 26, T. 8 N., R. 15 E., at the highway bridge 1 mile south of Harlowton. Takes place of station formerly maintained at Shawmut.

Records available.—July 11, 1907, to December 31, 1911.

Drainage area.—Not measured.

Gages.—The original gage was destroyed in October, 1908; on April 10, 1909, a temporary staff gage was installed which read 0.73 foot too high. On May 24, 1909, a standard chain gage was placed on the upstream side of the new public highway bridge at a datum 0.52 foot higher than the bench mark and the datum of the bench mark was raised 0.52 foot. All gage heights for 1909 were corrected to the new datum.

Channel.—Bed of stream composed of sand and gravel; will probably shift in flood.

Discharge measurements.—Made from bridge or by wading.

Diversions.—A large part of the valley is irrigated and many small ditches take water from the Musselshell; practically the entire flow of the stream is appropriated. A minimum discharge of 2 second-feet is recorded during the irrigation season at this station.

Discharge measurements of Musselshell River at Harlowton, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 14[a]	C. S. Heidel	0.80	54	July 27	C. S. Heidel	−0.02	11
Apr. 7	do	.91	118	Oct. 26	do	.81	80
June 3	do	4.10	2,580				

[a] Ice at gage.

Daily gage height, in feet, of Musselshell River at Harlowton, Mont., for 1911.

[W. G. Yamamoto, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		0.92	1.25	2.70	1.12	0.35	0.44	0.70	0.48
2		.98	1.20	3.55	1.08	.52	.35	.70	.55
3		1.08	1.20	4.05	.98	.55	.32	.70	.65
4		1.10	1.20	3.75	.92	.58	.52	.70	.65
5		1.10	1.20	3.30	.88	.72	.66	.70	.72
6		1.00	1.25	3.05	.80	1.15	.70	.70	.75
7		.98	1.60	2.85	.80	1.00	.70	.70	.75
8		.95	1.60	2.70	.80	1.00	.70	.70	.52
9		.98	1.60	2.60	.80	1.00	.70	.70	.55
10		1.01	1.68	2.50	.78	1.00	.70	.70	.55
11		1.04	1.58	2.40	.75	.95	.69	.70	.50
12	0.90	1.01	1.45	2.30	.68	.95	.65	.70	.50
13	.90	1.00	1.40	2.25	.64	.90	.65	.70	
14	.90	.95	1.45	2.20	.60	.82	.64	.70	
15	.90	.95	1.98	2.30	.54	.78	.62	.70	
16	.90	.90	2.40	2.20	.50	.75	.60	.72	
17	.90	.92	2.20	2.15	.48	.75	.59	.74	
18	1.00	.98	2.05	2.00	.45	.72	.52	.75	
19	1.12	1.00	1.95	1.95	.40	.70	.49	.75	
20	1.18	1.00	1.75	1.80	.35	.70	.45	.78	
21	1.30	1.00	1.68	1.75	.30	.66	.59	.78	
22	1.50	1.02	1.60	1.70	.22	.65	.68	.78	
23	1.50	1.18	1.70	1.65	.15	.60	.65	.80	
24	1.40	1.20	1.95	1.55	.10	.60	.65	.80	
25	1.38	1.15	2.35	1.48	.05	.60	.68	.80	
26	1.25	1.15	2.65	1.28	.00	.60	.70	.80	
27	1.20	1.28	2.60	1.20	−.02	.60	.70	.82	
28	1.10	1.40	2.40	1.18	−.04	.55	.70	.82	
29	1.08	1.40	2.30	1.15	−.05	.55	.70	.72	
30	1.02	1.30	2.30	1.15	−.10	.50	.70	.65	
31	.98		2.30		+.55	.50		.56	

Daily discharge, in second-feet, of Musselshell River at Harlowton, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	110	220	1,200	168	30	38	68	42
2	.....	125	200	2,010	154	46	30	68	50
3	.....	154	200	2,540	125	50	28	68	62
4	.....	160	200	2,210	110	53	46	68	62
5	.....	160	200	1,760	101	71	63	68	71
6	.....	130	220	1,520	85	180	68	68	76
7	.....	125	370	1,340	85	130	68	68	76
8	.....	118	370	1,200	85	130	68	68	46
9	.....	118	370	1,110	85	130	68	68	50
10	.....	133	412	1,020	82	130	68	68	50
11	.....	142	360	940	76	118	67	68	44
12	105	133	300	860	65	118	62	68	44
13	105	130	280	820	60	105	62	68	.....
14	105	118	300	780	55	89	60	68	.....
15	105	118	616	860	48	82	58	68	.....
16	105	105	940	780	44	76	55	71	.....
17	105	110	780	740	42	76	54	75	.....
18	130	125	665	630	39	71	46	76	.....
19	168	130	595	595	34	68	43	76	.....
20	192	130	460	490	30	68	39	82	.....
21	240	130	412	460	27	63	54	82	.....
22	320	136	370	430	22	62	65	82	.....
23	320	192	430	400	18	55	62	85	.....
24	286	200	595	345	16	55	62	85	.....
25	272	180	900	312	14	55	65	85	.....
26	220	180	1,160	232	12	55	68	85	.....
27	200	232	1,110	200	11	55	68	89	.....
28	160	280	940	192	10	50	68	89	.....
29	154	280	860	180	10	50	68	71	.....
30	136	240	860	180	8	50	68	62	.....
31	125	.....	860	.....	50	50	.....	51	.....

NOTE.—Daily discharge determined from a rating curve fairly well defined below 320 second-feet.

Monthly discharge of Musselshell River at Harlowton, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 45	2,770	D.
February	.....	.....	[a] 50	2,780	D.
March	320	.....	131	8,060	C.
April	280	105	154	9,160	B.
May	1,160	200	534	32,800	C.
June	2,540	180	878	52,200	C.
July	168	8	57.1	3,510	B.
August	180	30	78.1	4,800	B.
September	68	28	58.0	3,450	B.
October	89	51	73.1	4,490	B.
November	.....	.....	46.0	2,740	C.
December	.....	.....	[a] 40.0	2,460	D.
The year	.....	.....	179	129,000	

[a] Estimated.

NOTE.—Discharge Mar. 1-11 estimated at 65 second-feet and Nov. 13 to 30 at 40 second-feet.

CHECKERBOARD CREEK NEAR DELPINE, MONT.

Location.—In the SW. ¼ SW. ¼ sec. 4, T. 9 N., R. 9 E., 2½ miles above the junction of Checkerboard Creek with Musselshell River, 8 miles from Delpine post office, and 21 miles from Martinsdale, Mont.

Records available.—May 26, 1909, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff, nailed to a foot log near the right bank. This was superseded on April 9, 1911, by a vertical staff set at a different datum about 40 feet downstream at a better section.

Channel.—Gravel.

Discharge measurements.—Made from foot log or by wading.

Winter flow.—Affected by ice.

Diversions.—It is proposed to divert the water from this creek over a small divide into the reservoir on the North Fork of Musselshell River. The creek is about 12 miles long and has no tributaries.

Discharge measurements of Checkerboard Creek near Delpine, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 16	C. S. Heidel	0.30	3.0	June 5	C. S. Heidel	3.00	41
Apr. 9[a]	do	.52	7.4	Aug. 3	do	2.18	5.6
Apr. 9	do	2.34	7.7	Oct. 28	do	2.08	3.7
May 5	do	2.47	13.1				

[a] Last measurement at old gage.

Daily gage height, in feet, of Checkerboard Creek near Delpine, Mont., for 1911.

[Thomas Harbor, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1				3.30	2.20	2.19	2.15	2.15
2		0.50	2.28	3.15	2.20	2.30		2.15
3		.50	2.31			2.18	2.15	
4		.50	2.30	3.20			2.15	2.12
5		.50	2.47	3.00	2.18		2.15	
6		.50	2.55	2.98	2.18		2.15	2.10
7		.50	2.60	2.98	2.18	2.18	2.15	2.10
8		.50	2.70	2.95	2.18	2.18		2.12
9		2.34	2.71	2.97	2.20	2.18		
10			2.75	2.80	2.20	2.18	2.15	2.12
11		2.20	2.61	2.72	2.22	21.8		
12		2.23	2.60	2.75	2.23	2.18	2.15	2.12
13		2.25	2.47	2.71	2.25	2.18		
14		2.22	2.50	2.62	2.25	2.18	2.15	2.12
15		2.21	2.80	2.68	2.25	2.16		
16	0.30	2.22	2.75	2.62	2.25	2.16	2.15	2.12
17	.30	2.25			2.25		2.15	
18	.30	2.23	2.70	2.60	2.25	2.16		2.12
19	.35	2.18	2.70	2.62	2.25	2.15	2.15	
20	.40		2.71	2.60	2.23			2.10
21	.40	2.18	2.52	2.60	2.23	2.15	2.15	
22	.50	2.20		2.55	2.22	2.15		
23	.50	2.23	2.60	2.50	2.22	2.15	2.15	
24	.50	2.18	2.75	2.40	2.22	2.15	2.15	
25	.50	2.24	2.80		2.21	2.15		
26	.50	2.26	2.85	2.37	2.20	2.15	2.15	
27	.50	2.33	2.83	2.37	2.20	2.15		
28	.50	2.25	2.80	2.38		2.15	2.15	2.08
29	.50	2.27	2.80	2.40	2.19	2.15	2.15	
30	.50	2.26	2.83	2.38		2.15	2.15	
31	.50		2.85			2.15		

Daily discharge, in second-feet, of Checkerboard Creek near Delpine, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	7.0	7.4	64	5.8	5.6	4.9	4.9
2	.....	7.0	7.6	52	5.8	8.0	4.9	4.9
3	.....	7.0	8.2	54	5.6	5.4	4.9	4.6
4	.....	7.0	8.0	56	5.6	5.4	4.9	4.4
5	.....	7.0	13	41	5.4	5.4	4.9	4.2
6	.....	7.0	16	40	5.4	5.4	4.9	4.0
7	.....	7.0	18	40	5.4	5.4	4.9	4.0
8	.....	7.0	22	38	5.4	5.4	4.9	4.4
9	.....	9.0	23	39	5.8	5.4	4.9	4.4
10	.....	7.4	25	28	5.8	5.4	4.9	4.4
11	.....	5.8	18	23	6.2	5.4	4.9	4.4
12	.....	6.5	18	25	6.5	5.4	4.9	4.4
13	.....	6.9	13	23	6.9	5.4	4.9	4.4
14	.....	6.2	14	19	6.9	5.4	4.9	4.4
15	.....	6.0	28	21	6.9	5.1	4.9	4.4
16	3.0	6.2	25	19	6.9	5.1	4.9	4.4
17	3.0	6.9	24	18	6.9	5.1	4.9	4.4
18	3.0	6.5	22	18	6.9	5.1	4.9	4.4
19	4.0	5.4	22	19	6.9	4.9	4.9	4.2
20	5.0	5.4	23	18	6.5	4.9	4.9	4.0
21	5.0	5.4	15	18	6.5	4.9	4.9	4.0
22	7.0	5.8	16	16	6.2	4.9	4.9	4.0
23	7.0	6.5	18	14	6.2	4.9	4.9	3.9
24	7.0	5.4	25	10.5	6.2	4.9	4.9	3.9
25	7.0	6.7	28	9.9	6.0	4.9	4.9	3.8
26	7.0	7.1	31	9.8	5.8	4.9	4.9	3.8
27	7.0	8.8	30	9.8	5.8	4.9	4.9	3.7
28	7.0	6.9	28	10.5	5.7	4.9	4.9	3.7
29	7.0	7.3	28	10.5	5.6	4.9	4.9	3.7
30	7.0	7.1	30	10.5	5.6	4.9	4.9	3.7
31	7.0	.....	31	.....	5.6	4.9	.....	3.7

NOTE.—Daily discharge determined as follows: Mar. 16 to Apr. 8 (old section) and Apr. 9 to Oct. 28 (new section) from rating curves fairly well defined. Discharge interpolated for days for which gage heights are missing.

Monthly discharge of Checkerboard Creek near Delpine, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	3.0	184	D.
February	.....	.....	3.0	167	D.
March	7.0	.....	4.5	277	C.
April	9.0	5.4	6.71	399	B.
May	31.0	7.4	20.5	1,260	B.
June	64.0	9.8	25.8	1,540	B.
July	6.9	5.4	6.09	374	B.
August	8.0	4.9	5.24	322	B.
September	4.9	4.9	4.90	292	B.
October	4.9	3.7	4.18	257	C.
November	.....	.....	3.5	208	D.
December	.....	.....	3.5	215	D.
The year	64	.....	7.58	5,500	

NOTE.—Means for January, February, November, and December estimated; mean for period Mar. 1-15 estimated at 3.0 second-feet.

SOUTH FORK OF MUSSELSHELL RIVER NEAR MARTINSDALE, MONT.

Location.—In the S. ½ sec. 12, T. 8 N., R. 11 E., near the public highway, 1¼ miles northeast of Martinsdale, near the blacksmith's shop of the Martinsdale Sheep Co., at a point about 1½ miles above the original site, which was near the ranch of M. J. Settle.

Records available.—June 19, 1907, to April 28, 1908 (old station); April 28, 1908, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff nailed to tree on the right bank; datum unchanged. The datum of this gage bears no determined relation to the datum of the gage at the original station.

Channel.—Bed of stream is chiefly gravel and is clean and nonshifting.

Discharge measurements.—Made by wading near the gage or from a bridge 150 feet below.

Winter flow.—Affected by ice.

Diversions.—Many small ditches take water from the creek and during the irrigating season all the water is diverted.

Accuracy.—Open season records good.

Discharge measurements of South Fork of Musselshell River near Martinsdale, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 17	C. S. Heidel	(a)	6.8	June 4	C. S. Heidel	5.75	1,180
Apr. 8	do	1.75	41	July 28	do	0.90	3.2
May 6	do	3.01	174	Oct. 27	do	1.55	25

[a] Ice conditions.

Daily gage height, in feet, of South Fork of Musselshell River near Martinsdale, Mont., for 1911.

[J. G. Wallace, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1		2.05	2.4	4.5	2.1	0.8	1.15	1.3
2		2.35	2.4	5.8	2.0	0.9	1.5	1.4
3		2.05	2.3	5.8	1.95	0.9	1.5	1.4
4		1.55	2.5	5.8	1.9	1.5	1.3	1.4
5		1.5	2.5	5.7	1.8	1.5	1.3	1.45
6		1.65	2.6	5.1	1.25	1.5	1.35	1.45
7		1.65	3.3	4.9	1.4	1.3	1.3	1.5
8		1.75	3.2	4.8	1.3	1.4	1.3	1.5
9		2.0	3.5	4.8	1.0	1.5	1.3	1.5
10		2.0	3.3	4.4	1.0	1.6	1.3	1.5
11		2.15	3.3	4.2	1.0	1.6	1.25	1.5
12		2.0	3.0	4.0	1.0	1.65	1.2	1.5
13		1.9	3.3	4.0	0.95	1.6	1.2	1.5
14		1.8	3.3	4.2	0.8	1.65	1.2	1.5
15		1.8	4.0	3.9	0.8	1.5	1.2	1.5
16		1.8	4.9	3.9	0.8	1.5	1.2	1.5
17		1.9	4.2	3.7	0.8	1.4	1.2	1.55
18		1.9	4.0	3.0	0.8	1.4	1.25	1.55
19	2.05	2.0	3.7	3.1	0.85	1.4	1.25	1.55
20	2.1	2.0	5.5	3.1	0.8	1.45	1.25	1.5
21	2.65	2.2	3.3	3.0	0.8	1.45	1.25	1.5
22	2.75	2.2	3.2	2.9	0.8	1.3	1.2	1.5
23	2.05	2.3	3.2	2.0	0.8	1.35	1.25	1.5
24	2.05	2.3	3.6	2.8	0.8	1.35	1.25	1.4
25	2.0	2.3	4.8	2.5	1.5	1.3	1.25	1.4
26	1.05	2.4	4.6	2.4	1.0	1.2	1.25	1.45
27	1.05	2.45	4.6	2.35	0.9	1.2	1.25	1.55
28	1.55	2.5	4.4	2.3	0.9	1.25	1.25	1.55
29	1.85	2.5	4.3	2.2	0.9	1.2	1.25	1.55
30	1.4	2.5	4.2	2.15	0.85	1.15	1.3	1.6
31	1.55		4.0		0.85	1.15		1.75

Daily discharge, in second-feet, of South Fork of Musselshell River near Martinsdale, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	66	104	555	71	2	9.5	15
2	.....	98	104	1,260	62	3	24	19
3	.....	66	92	1,260	58	3	24	19
4	.....	27	116	1,260	53	24	15	19
5	.....	24	116	1,200	45	24	15	22
6	.....	34	128	846	13	24	17	22
7	.....	34	231	740	19	15	15	24
8	.....	41	214	690	15	19	15	24
9	.....	62	268	690	5	24	15	24
10	.....	62	231	516	5	30	15	24
11	.....	76	231	447	5	30	13	24
12	.....	62	183	390	5	34	11	24
13	.....	53	231	390	4	30	11	24
14	.....	45	231	447	2	34	11	24
15	.....	45	390	363	2	24	11	24
16	.....	45	740	363	2	24	11	24
17	.....	53	447	312	2	19	11	27
18	.....	53	390	183	2	19	13	27
19	66	62	312	198	2.5	19	13	27
20	71	62	1,080	198	2	22	13	24
21	134	81	231	183	2	22	13	24
22	148	81	214	168	2	15	11	24
23	66	92	214	62	2	17	13	24
24	66	92	289	154	2	17	13	19
25	62	92	690	116	24	15	13	19
26	6.5	104	597	104	5	11	13	22
27	6.5	110	597	98	3	11	13	27
28	27	116	516	92	3	13	13	27
29	49	116	480	81	3	11	13	27
30	19	116	447	76	2.5	9.5	15	30
31	27	.....	390	.....	2.5	9.5	.....	41

NOTE.—Daily discharge determined from 1910 rating curve that is well defined.

Monthly discharge of South Fork of Musselshell River near Martinsdale, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 10	615	D.
February	.....	.....	[a] 7	389	D.
March	148	.....	35.8	2,200	C.
April	116	24	69.0	4,110	A.
May	1,080	92	339	20,800	A.
June	1,260	62	448	26,700	A.
July	71	2	13.7	842	A.
August	34	2	18.5	1,140	A.
September	24	9.5	13.8	821	A.
October	41	15	24.0	1,480	A.
November	.....	.....	[a] 18.0	1,070	D.
December	.....	.....	[a] 12.0	738	D.
The year	1,260	2	84.1	60,900	

[a] Estimated.

NOTE.—Discharge Mar. 1 to 18 estimated at 20 second-feet.

AMERICAN FORK NEAR HARLOWTON, MONT.

Location.—At the Shaw & Elliott ranch, 5 miles southeast of Harlowton, Mont., a few miles above the junction of the American Fork with the Musselshell.

Records available.—July 28, 1907, to December 31, 1911.

Gage.—Chain fastened to upper rail of small wagon bridge; datum unchanged.

Channel.—Bed composed of sand and clay; shifts only at extremely high stages.

Discharge measurements.—Made from the bridge or by wading.

Winter flow.—Affected by ice.

Storage.—The basin of the American Fork affords some good storage sites and by holding back the spring flood waters, which are derived from the melting snow on the mountains, much more land can be put under irrigation.

Accuracy.—Open season records good.

Discharge measurements of American Fork near Harlowton, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 14	C. S. Heidel	(a)	0.9	June 3	C. S. Heidel	3.77	544
Apr. 7	do	1.32	3.2	Oct. 26	do	1.20	2·5

a Ice conditions.

Daily gage height, in feet, of American Fork near Harlowton, Mont., for 1911.

[Jesse Cunningham, observer]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		1.3	1.3	2.9	1.15			1.2	1.15
2		1.3	1.3	3.65	1.15	1.15		1.2	1.15
3		1.3	1.25	3.75	1.15	1.05		1.15	1.15
4		1.3	1.25	3.7	1.05	1.15		1.2	1.15
5		1.3	1.25	3.6	1.45	1.15		1.25	1.15
6		1.3	1.2	3.55	0.95	1.1	1.45	1.2	
7		1.3	1.2	3.55	1.05	1.05	1.05	1.25	
8		1.2	1.2	2.75	1.15	1.15	1.1	1.2	
9		1.25	1.25	2.75	1.45	1.2	1.15	1.2	
10		1.3	1.3	2.5	0.95	1.15	1.1	1.2	
11		1.25	1.3	2.4	0.95	1.15	1.1	1.25	
12		1.25	1.3	2.55	0.95	1.1	1.1	1.2	
13		1.25	1.2	2.35	0.95	1.1	1.05	1.15	
14		1.25	1.25	2.4	0.9	1.05	1.05	1.2	
15		1.25	1.45	2.35	0.9	1.05	1.05	1.2	
16		1.2	2.65	2.4	0.9	0.95	0.95	1.1	
17		1.25	2.55	2.2	0.9	0.9	0.95	1.2	
18		1.3	2.4	2.0	1.0	0.9	1.45	1.2	
19		1.3	2.1	1.85	0.95	0.85	1.45	1.2	
20		1.3	1.9	1.85	0.95		1.05	1.1	
21		1.25	1.85	1.8	0.9		1.05	1.2	
22		1.3	1.8	1.85	0.8		1.05	1.2	
23		1.35	1.55	1.75	0.85		1.1	1.15	
24		1.35	1.8	1.75	0.8		1.1	1.2	
25		1.3	2.5	1.1		0.9	1.15	1.2	
26	1.35	1.25	2.65	1.1		0.95	1.2	1.2	
27	1.3	1.35	2.85	1.2	0.5	1.05	1.15	1.1	
28	1.3	1.4	2.6	1.2		1.05	1.15	1.1	
29	1.3	1.35	2.6	1.3		0.95	1.2	1.1	
30	1.3	1.3	2.4	1.2		0.85	1.2	1.1	
31	1.35		2.55					1.15	

Daily discharge, in second-feet, of American Fork near Harlowton, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.5	3.5	220	1.8	0.9	1.8	2.0	1.8
2	.....	3.5	3.5	490	1.8	1.8	3.0	2.0	1.8
3	.....	3.5	2.8	535	1.8	1.2	4.2	1.8	1.8
4	.....	3.5	2.8	510	1.2	1.8	5.4	2.0	1.8
5	.....	3.5	2.8	470	8.0	1.8	6.7	2.8	1.8
6	.....	3.5	2.0	450	.8	1.5	8.0	2.0	.....
7	.....	3.5	2.0	450	1.2	1.2	1.2	2.8	.....
8	.....	2.0	2.0	182	1.8	1.8	1.5	2.0	.....
9	.....	2.8	2.8	182	8.0	2.0	1.8	2.0	.....
10	.....	3.5	3.5	130	.8	1.8	1.5	2.0	.....
11	.....	2.8	3.5	112	.8	1.8	1.5	2.8	.....
12	.....	2.8	3.5	140	.8	1.5	1.5	2.0	.....
13	.....	2.8	2.0	104	.8	1.5	1.2	1.8	.....
14	.....	2.8	2.8	112	.7	1.2	1.2	2.0	.....
15	.....	2.8	8.0	104	.7	1.2	1.2	2.0	.....
16	.....	2.0	160	112	.7	.8	.8	1.5	.....
17	.....	2.8	140	81	.7	.7	.8	2.0	.....
18	.....	3.5	112	54	1.0	.7	8.0	2.0	.....
19	.....	3.5	67	37	.8	.6	8.0	2.0	.....
20	.....	3.5	42	37	.8	.6	1.2	1.5	.....
21	.....	2.8	37	32	.7	.6	1.2	2.0	.....
22	.....	3.5	32	37	.5	.6	1.2	2.0	.....
23	.....	4.8	13	28	.6	.7	1.5	1.8	.....
24	.....	4.8	32	28	.5	.7	1.5	2.0	.....
25	.....	3.5	130	1.5	.0	.7	1.8	2.0	.....
26	4.8	2.8	160	1.5	.0	.8	2.0	2.0	.....
27	3.5	4.8	208	2.0	.0	1.2	1.8	1.5	.....
28	3.5	6.0	150	2.0	.0	1.2	1.8	1.5	.....
29	3.5	4.8	150	3.5	.0	.8	2.0	1.5	.....
30	3.5	3.5	112	2.0	.0	.6	2.0	1.5	.....
31	4.8	.....	140	.....	.0	.6	.....	1.8	.....

NOTE.—Daily discharge determined from a rating curve that is fairly well defined. Discharge interpolated for days for which gage heights are missing.

Monthly discharge of American Fork near Harlowton, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 1.00	61	D.
February	.....	.....	[a] .90	50	D.
March	4.8	.....	1.57	97	D.
April	6.0	2.0	3.45	205	C.
May	208	2.0	55.9	3,440	C.
June	535	1.5	155	9,220	C.
July	8.0	.0	1.20	74	C.
August	2.0	.6	1.13	69	C.
September	8.0	.8	2.58	154	C.
October	2.8	1.5	1.95	120	C.
November	.....	.....	[a] 1.00	60	D.
December	.....	.....	[a] 1.00	61	D.
The year	535	.....	18.8	13,600	

[a] Estimated.

NOTE.—Discharge Mar. 1 to 25 estimated at 1 second-foot.

LEBO CREEK NEAR HARLOWTON, MONT.

Location.—Near the Shaw & Elliott ranch, 5 miles southeast of Harlowton, half a mile above the junction of the creek with American Fork.

Records available.—July 28, 1907, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff on the right bank, nailed to the pile of the small wagon bridge; its datum is the same as that of the gage on the American Fork.

Channel.—Contains growth of grass.

Discharge measurements.—Made by wading.

Winter flow.—Affected by ice.

Diversions.—The water of the stream is used for irrigation.

Accuracy.—Records only fair as gage heights are affected by backwater caused by grass in the stream bed.

Lebo Creek is about 20 miles long, is fed by springs, and its flow is nearly uniform.

Discharge measurements of Lebo Creek near Harlowton, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 14[a]	C. S. Heidel	.....	21	July 27	C. S. Heidel	.98	7.3
Apr. 7	.....do	1.28	24	Oct. 26	.....do	1.40	22
June 3	.....do	1.85	42				

[a] Creek frozen at gage.

Daily gage height, in feet, of Lebo Creek near Harlowton, Mont., for 1911.

[Neva Clark, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.2	1.15	1.9	1.0	1.15	1.25	1.25	1.45
2	.....	1.2	1.1	2.15	1.0	1.15	1.3	1.25	1.35
3	.....	1.15	1.5	1.85	.95	1.15	1.35	1.25	1.25
4	.....	1.2	1.1	1.7	.9	1.2	1.35	1.25	1.25
5	.....	1.15	1.1	1.65	.9	1.2	1.3	1.25	1.15
6	.....	1.25	1.1	1.6	.9	1.25	1.4	1.25	.....
7	.....	1.3	1.1	1.55	.95	1.15	1.35	1.25	.....
8	.....	1.25	1.0	1.4	1.0	1.3	1.35	1.25	.....
9	.....	1.2	1.1	1.4	.95	1.45	1.3	1.15	.....
10	.....	1.2	1.15	1.35	.9	1.4	1.25	1.15	.....
11	.....	1.1	1.5	1.3	.9	1.35	1.25	1.15	.....
12	.....	1.1	1.5	1.35	.9	1.45	1.25	1.15	.....
13	.....	1.1	1.1	1.4	1.5	1.4	1.25	1.15	.....
14	.....	1.1	1.1	1.4	1.0	1.45	1.25	1.15	.....
15	.....	1.1	1.1	1.45	1.5	1.45	1.25	1.15	.....
16	.....	1.0	1.25	1.55	1.0	1.4	1.25	1.15	.....
17	.....	1.0	1.15	1.5	.95	1.4	1.25	1.25	.....
18	.....	1.0	1.1	1.4	.8	1.4	1.25	1.25	.....
19	.....	1.0	1.1	1.4	.8	1.4	1.25	1.25	.....
20	.....	1.1	1.5	1.4	.8	1.35	1.2	1.25	.....
21	.....	1.1	1.5	1.45	.75	1.35	1.25	1.25	.....
22	.....	1.15	1.5	1.4	.65	1.3	1.25	1.25	.....
23	.....	1.15	1.2	1.35	.65	1.3	1.3	1.25	.....
24	.....	1.15	1.3	1.35	.65	1.3	1.3	1.3	.....
25	.....	1.1	2.6	1.2	.7	1.35	1.25	1.3	.....
26	1.4	1.1	2.6	1.2	.75	1.35	1.25	1.4	.....
27	1.3	1.15	2.1	1.15	1.0	1.35	1.2	1.4	.....
28	1.3	1.2	2.5	1.1	.95	1.35	1.2	1.45	.....
29	1.25	1.2	1.8	1.0	.95	1.3	1.25	1.45	.....
30	1.3	1.1	1.8	1.5	1.45	1.3	1.25	1.4	.....
31	1.2	.....	1.6	.....	1.25	1.3	.....	1.35	.....

NOTE.—Daily discharge determined as follows: Mar. 26 to May 24, from curve poorly defined; May 25 to June 2, by indirect method for shifting channels; June 3 to Nov. 5, from curve fairly well defined.

Daily discharge, in second-feet, of Lebo Creek near Harlowton, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	21	19	50	8	12	16	16	24
2	.....	21	17	64	8	12	18	16	20
3	.....	19	33	40	7	12	20	16	16
4	.....	21	17	34	6	14	20	16	16
5	.....	19	17	32	6	14	18	16	12
6	.....	23	17	30	6	16	22	16	.....
7	.....	25	17	28	7	12	20	16	.....
8	.....	23	14	22	8	18	20	16	.....
9	.....	21	17	22	7	24	18	12	.....
10	.....	21	19	20	6	22	16	12	.....
11	.....	17	33	18	6	20	16	12	.....
12	.....	17	33	20	6	24	16	12	.....
13	.....	17	17	22	26	22	16	12	.....
14	.....	17	17	22	8	24	16	12	.....
15	.....	17	17	24	26	24	16	12	.....
16	.....	14	23	28	8	22	16	12	.....
17	.....	14	19	26	7	22	16	16	.....
18	.....	14	17	22	4	22	16	16	.....
19	.....	14	17	22	4	22	16	16	.....
20	.....	17	33	22	4	20	14	16	.....
21	.....	17	33	24	3	20	16	16	.....
22	.....	19	33	22	1.5	18	16	16	.....
23	.....	19	21	20	1.5	18	18	16	.....
24	.....	19	25	20	1.5	18	18	18	.....
25	.....	17	88	14	2	20	16	18	.....
26	29	17	88	14	3	20	16	22	.....
27	25	19	64	12	8	20	14	22	.....
28	25	21	80	11	7	20	14	24	.....
29	23	21	45	8	7	18	16	24	.....
30	25	17	45	26	24	18	16	22	.....
31	21	.....	34	.....	16	18	.....	20	.....

Monthly discharge of Lebo Creek near Harlowton, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	*a* 10	615	D.
February	.....	.....	*a* 15	833	D.
March	.....	.....	*a* 20	1,230	D.
April	25	14	18.6	1,110	C.
May	88	14	31.3	1,920	C.
June	64	8	24.6	1,460	B.
July	26	1.5	7.82	481	B.
August	24	12	18.9	1,160	B.
September	22	14	16.9	1,010	B.
October	24	12	16.3	1,000	B.
November	.....	.....	*a* 12	714	D.
December	.....	.....	*a* 10	615	D.
The year	88	.....	16.8	12,100	

a Estimated.

FLATWILLOW CREEK NEAR FLATWILLOW, MONT.

Location.—At Flatwillow Ranch Co.'s ranch, 8 miles above Flatwillow and 30 miles north of Roundup.

Records available.—May 3 to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff gage, marked to tenths of feet, nailed to a timber driven into bed of stream and braced to the banks; below the wagon bridge near the ranch buildings.

Channel.—Likely to shift; current very sluggish.

Discharge measurements.—At high stages made from a footbridge behind house; at low water made by wading around a bend below house.

Winter flow.—Affected by ice.

Diversions.—Much water is diverted above the gage during the irrigating season. A canal to divert water into the storage reservoir of the Flatwillow Carey project heads about a mile above the station.

Discharge measurements of Flatwillow Creek near Flatwillow, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 3	C. S. Heidel	3.15	23
June 1	do	6.71	253
July 26	do	2.59	4.5
Oct. 25	do	3.15	29

Daily gage height, in feet, of Flatwillow Creek near Flatwillow, Mont., for 1911.

[Lee Akers, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	6.8	3.6	2.8	2.8	2.7	3.1	3.2
2	.....	7.1	3.6	2.9	2.8	2.7	3.0	3.2
3	3.13	7.2	3.4	3.1	2.7	2.7	3.0	3.3
4	3.10	7.2	3.3	3.2	2.7	2.8	3.0	3.3
5	3.11	6.9	3.3	3.2	2.7	2.8	3.0	3.3
6	3.11	6.5	3.1	3.3	2.8	2.9	3.0	3.2
7	3.08	6.2	3.1	3.5	2.8	2.8	3.0	3.3
8	3.12	5.9	3.3	3.6	2.9	2.9	3.0	.....
9	3.18	5.8	3.3	3.7	2.9	2.9	3.0	.....
10	3.12	5.8	3.3	3.7	2.9	2.9	3.0	.....
11	3.11	5.6	3.2	3.6	2.9	2.9	3.0	.....
12	3.00	5.5	2.9	3.6	2.8	3.0	3.0	.....
13	3.02	5.3	2.9	3.4	2.8	2.9	3.0	.....
14	2.86	5.2	2.8	3.4	2.7	3.0	3.1	.....
15	3.85	5.1	2.9	3.3	2.6	3.2	3.1	.....
16	6.2	5.1	2.9	3.2	2.6	3.2	2.9	.....
17	4.3	4.8	2.8	3.2	2.6	3.3	2.9	3.2
18	4.0	4.6	2.8	3.6	2.6	3.4	2.9	3.2
19	3.9	4.4	2.8	3.4	2.7	3.4	2.9	3.2
20	3.8	4.2	2.9	3.4	2.8	3.4	3.0	3.1
21	3.8	4.1	2.8	3.4	2.8	3.2	3.0	3.1
22	3.9	4.2	2.8	3.4	2.8	3.1	3.0	3.1
23	3.8	4.2	2.8	3.3	2.8	3.0	3.0	3.1
24	4.3	4.1	2.8	3.3	2.8	3.1	3.1	3.1
25	5.2	4.0	2.7	3.3	2.8	3.0	3.1	3.1
26	6.6	4.0	2.6	3.3	2.8	3.1	3.3	3.1
27	6.6	3.9	2.6	3.3	2.7	2.9	3.3	3.1
28	6.2	3.9	2.6	3.2	2.7	2.9	3.3	3.1
29	6.2	3.8	2.7	3.1	2.7	2.8	3.3	3.1
30	6.1	3.7	2.7	3.1	2.7	2.9	3.2	3.1
31	6.2	.....	2.7	2.8	.....	3.0	.....	3.1

NOTE.—Gage heights distorted by ice Nov. 24 to Dec. 31.

Daily discharge, in second-feet, of Flatwillow Creek near Flatwillow Mont., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	25	260	47	12	12	8	24
2	25	284	47	16	12	8	20
3	25	292	37	24	8	8	20
4	24	292	32	28	8	12	20
5	24	268	32	28	8	12	20
6	24	236	24	32	12	16	20
7	23	212	24	42	12	12	20
8	25	191	32	47	16	16	20
9	27	184	32	52	16	16	20
10	25	184	32	52	16	16	20
11	24	170	28	47	16	16	20
12	20	163	16	47	12	20	20
13	21	149	16	37	12	16	20
14	14	142	12	37	8	20	24
15	14	135	16	32	5	28	24
16	212	135	16	28	5	28	16
17	85	115	12	28	5	32	16
18	67	103	12	47	5	37	16
19	62	91	12	37	8	37	16
20	57	79	16	37	12	37	20
21	57	73	12	37	12	28	20
22	62	79	12	37	12	24	20
23	57	79	12	32	12	20	20
24	85	73	12	32	12	24	20
25	142	67	8	32	12	20	20
26	244	67	5	32	12	24	20
27	244	62	5	32	8	16	20
28	212	57	5	28	8	16	20
29	212	57	8	24	8	12	20
30	205	52	8	24	8	16	20
31	212	.....	8	12	.....	20	.....

NOTE.—Daily discharge determined from a rating curve not well defined. Discharge estimated for days for which gage heights are missing.

Monthly discharge of Flatwillow Creek near Flatwillow, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	244	14	82.4	5,070	C.
June	292	52	145.0	8,630	C.
July	47	5	19.0	1,170	C.
August	52	12	33.3	2,050	C.
September	16	5	10.4	619	C.
October	37	8	19.8	1,220	C.
November	24	16	19.9	1,180	C.
December	.....	.....	[a] 20.0	1,230	D.
The period	.....	.....	.....	21,200	

[a] Estimated.

MILK RIVER BASIN.

SOUTH FORK OF MILK RIVER NEAR BROWNING, MONT.

Location.—At Richard Croff's ranch, about 40 miles northeast of Browning, Mont., and about 6 miles south of the Canadian boundary line.

Records available.—April 28, 1905, to December 31, 1911.

Drainage area.—283 square miles.

Gage.—Chain. During the high water of June, 1908, the gage was washed out and was not replaced until July 31, 1908, when the new chain gage was installed at the original site and datum.

Channel.—Permanent.

Discharge measurements.—Made from a cable installed at the time of the installation of the new gage.

Winter flow.—Affected by ice.

Flood discharge.—The river overflows its banks at gage height of 12 feet; highwater marks show that the flood of June, 1908, reached a stage of 15.4 feet on the gage. The flood width was 850 feet and the cross section about 2,600 square feet.

Diversions.—A number of small ditches divert water to irrigate meadow lands in the river bottom; a considerable amount of this water returns to the stream as seepage and waste. No storage is used above the station.

Accuracy.—Records excellent except during the winter months.

Discharge measurements of South Fork of Milk River near Browning, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 9	B. E. Jones	3.54	180
Aug. 29	do	2.71	44

Daily gage height, in feet, of South Fork of Milk River near Browning, Mont., for 1911.

[R. J. Croff, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1		3.42	3.5	3.9	3.01	2.55	2.95
2		3.45	3.6	3.55	2.96	2.5	2.95
3		3.55	3.6	3.5	3.26	2.45	2.95
4		3.55	3.6	3.4	3.06	3.25	3.05
5		3.75	3.5	3.38	3.21	4.35	3.1
6		3.9	3.5	3.32	3.04	4.35	3.05
7		3.75	3.4	3.16	3.16	4.25	2.95
8		3.5	3.6	3.03	3.21	4.15	2.95
9		3.6	3.7	2.98	3.16	3.8	2.9
10		3.5	3.45	2.98	3.08	3.55	2.9
11		3.5	3.39	2.97	3.12	3.27	2.9
12		3.42	3.34	2.95	2.94	3.15	2.9
13		3.48	3.29	2.89	2.94	3.05	2.9
14		4.2	3.29	2.87	2.76	3.0	2.9
15		4.75	3.27	2.87	2.76	2.95	2.9
16		6.3	3.21	2.89	2.71	2.95	2.9
17		5.15	3.19	3.22	2.71	2.95	2.9
18		4.2	3.14	3.07	2.69	2.95	2.9
19		3.95	3.09	3.27	2.64	2.95	2.9
20		3.8	2.99	3.22	2.61	2.93	2.9
21		3.7	3.18	2.97	2.63	2.9	2.9
22		3.7	3.55	2.97	2.6	3.0	2.95
23	3.9	3.75	3.3	2.95	2.65	3.05	2.95
24	3.9	3.7	4.3	2.95	2.63	3.17	2.95
25	4.0	3.8	5.95	2.89	2.6	3.25	2.9
26	4.15	3.9	4.8	2.82	2.6	3.2	2.45
27	4.0	3.9	3.85	2.77	2.65	3.13	2.45
28	3.65	3.9	3.9	2.77	2.65	2.97	2.55
29	3.5	3.75	3.8	2.72	2.6	3.05	2.7
30	3.42	3.6	3.55	2.79	2.67	2.95	2.65
31		3.55		2.99	2.55		2.65

Daily discharge, in second-feet, of South Fork of Milk River near Browning, Mont., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	154	172	273	80	28	72
2	.....	161	195	184	73	23	72
3	.....	184	195	172	122	20	72
4	.....	184	195	150	88	120	86
5	.....	133	172	146	113	400	94
6	.....	273	172	134	85	400	86
7	.....	133	150	104	104	372	72
8	.....	172	195	84	113	342	72
9	.....	195	220	76	104	246	65
10	.....	172	161	76	91	184	65
11	.....	172	148	75	97	124	65
12	.....	154	138	72	71	102	65
13	.....	168	128	64	71	86	65
14	.....	357	128	61	48	79	65
15	.....	520	124	61	48	72	65
16	.....	1,040	113	64	43	72	65
17	.....	648	109	115	43	72	65
18	.....	357	101	90	41	72	65
19	.....	286	92	124	36	72	65
20	.....	246	78	115	33	69	65
21	.....	220	108	75	35	65	65
22	.....	220	184	75	32	79	72
23	273	233	130	72	37	86	72
24	273	220	386	72	35	106	72
25	300	246	918	64	32	120	65
26	342	273	536	55	32	111	20
27	300	273	260	49	37	99	20
28	208	273	273	49	37	75	28
29	172	233	246	44	32	86	42
30	154	195	184	51	39	72	37
31	.....	184	.....	78	28	.....	37

NOTE.—Daily discharge determined from a well-defined rating curve.

Monthly discharge of South Fork of Milk River near Browning, Mont., for 1911.

[Drainage area, 283 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
April 23–30	.....	.....	253	.894	0.27	4,010	A.
May	1,040	133	267	.943	1.09	16,400	A.
June	918	78	207	.731	.82	12,300	A.
July	273	44	94.3	.333	.38	5,800	A.
August	122	28	60.6	.214	.25	3,730	A.
September	400	20	128	.452	.50	7,620	A.
October	94	20	62.5	.221	.25	3,840	A.
The period	.....	.....	.....	.....	.....	53,700	

MILK RIVER AT HAVRE, MONT.

Location.—In SE. ¼ SE. ¼ sec. 5, T. 32 N., R. 16 E., at the highway bridge over Milk River at Havre, Mont.

Records available.—May 15, 1898, to December 31, 1911.

Drainage area.—About 7,300 square miles.

Gage.—Chain fastened to bridge rail on the downstream side; datum unchanged.

Channel.—Shifts.

Discharge measurements.—Made from bridge or by wading.

Winter flow.—From the last part of November to the first part of April the river at Havre is frozen entirely over and in portions of the cross sections it is usually frozen to the bottom.

Diversions.—An irrigation company in southern Alberta, Can., has been granted an appropriation of 500 second-feet of the low-water flow and 1,500 second-feet of the high-water flow, and a canal of 330 second-feet capacity has been partially constructed but no water has been diverted. There are no other important irrigation rights above Havre, but farther downstream are five large canal systems supplied directly from Milk River and irrigating about 22,000 acres. Preliminary steps toward the adjudication of the water rights of these various systems have been taken. A suit in behalf of the Fort Belknap Indians was decided in their favor with the result that they were given a prior right over the other canals to 125 second-feet, the priority of the other rights not being touched upon. Although no provision for storage has been made by the above claimants, the entire unappropriated flow of the stream has been filed upon by the United States Reclamation Service in connection with its Milk River irrigation project now under construction.

Accuracy.—Frequent discharge measurements are necessary to properly define the rating curve, and even with these the estimates are subject to considerable error. In years of low precipitation the flow ceases entirely and the water stands in pools for several months.

Discharge measurements of Milk River at Havre, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 15	W. A. Lamb	6.98	541	June 26	J. C. Beebe	7.22	745
28	J. C. Beebe	7.29	657	28	do	9.11	2,030
May 3	do	[a] 6.30	135	July 4	do	7.30	715
3	do	[a] 6.60	304	8	do	6.70	334
6	do	6.16	244	27	do	5.83	86
23	do	7.13	579	Aug. 2	do	5.72	78
30	do	6.72	366	31	R. Richards	5.48	42
June 17	do	6.11	174	Oct. 12	W. A. Lamb	6.50	253

[a] Sand bar under gage; gage height of no value.

Daily gage height, in feet, of Milk River at Havre, Mont., for 1911.

[U. S. Weather Bureau, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	6.8	7.1	6.6	7.3	5.7	5.4	6.3	6.2
2	.....	6.8	6.9	6.6	8.3	5.7	5.4	6.5	.....
3	.....	6.7	6.8	6.7	8.2	5.8	5.4	6.6	.....
4	.....	6.7	6.3	6.7	7.4	5.8	5.4	6.6	6.1
5	.....	6.6	6.1	6.6	7.1	5.7	8.7	6.9	6.2
6	.....	6.2	6.4	6.5	7.1	5.9	9.6	7.2	6.1
7	.....	6.1	6.1	6.3	7.1	5.9	10.3	7.1	6.2
8	.....	6.8	6.1	6.4	6.8	6.0	9.0	6.5	.....
9	6.2	6.6	6.1	6.6	6.7	6.1	8.5	6.5	.....
10	5.9	6.5	6.4	6.7	6.6	6.1	8.1	6.4	.....
11	5.7	6.3	6.3	6.3	6.4	6.1	7.2	6.6	.....
12	5.7	6.4	6.5	6.3	6.3	6.3	6.9	6.5	.....
13	5.7	6.4	6.3	6.2	6.3	6.7	6.7	6.6	.....
14	.....	6.8	6.2	6.1	6.2	6.4	7.3	6.5	.....
15	.....	7.1	6.3	6.1	6.1	6.3	7.2	6.5	.....
16	.....	6.9	6.4	6.3	6.1	6.4	7.0	6.4	.....
17	.....	6.6	6.5	6.2	6.1	6.1	6.9	6.5	.....
18	6.2	6.5	6.6	6.2	6.0	6.0	6.7	6.4	.....
19	6.5	6.5	8.5	6.1	6.0	6.0	6.7	6.5	.....
20	6.7	6.4	8.2	6.1	5.9	5.9	6.6	6.3	.....
21	6.8	6.3	7.4	6.2	6.0	5.7	6.5	6.4	.....
22	7.2	6.3	7.2	6.2	5.9	5.7	6.6	6.4	.....
23	6.8	6.3	7.1	6.3	5.9	5.7	6.7	6.5	.....
24	7.8	6.2	6.8	6.2	5.9	5.6	6.7	6.4	.....
25	7.8	6.3	6.9	6.3	5.8	5.6	6.7	6.5	.....
26	7.6	6.5	6.8	6.7	5.8	5.6	6.6	6.4	.....
27	7.5	7.0	6.9	7.5	5.8	5.6	6.7	6.3	.....
28	7.3	7.2	6.8	9.5	5.8	5.5	6.4	6.2	.....
29	7.2	6.9	6.7	8.3	5.7	5.5	6.5	6.3	.....
30	7.1	7.0	6.9	7.8	5.7	5.4	6.3	6.1	.....
31	7.0	.....	6.7	.....	5.6	5.4	.....	6.2	.....

Daily discharge, in second-feet, of Milk River at Havre, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	10	410	575	315	710	70	35	210	180
2	30	410	460	315	1,420	70	35	275	171
3	50	360	410	360	1,340	85	35	315	163
4	70	360	210	360	780	85	35	315	155
5	90	315	155	315	575	70	1,720	460	180
6	110	180	240	275	575	105	2,410	640	155
7	130	155	155	210	575	105	2,980	575	180
8	150	410	155	240	410	130	1,940	275	.....
9	180	315	155	315	360	155	1,570	275	.....
10	105	275	240	360	315	155	1,270	240	.....
11	70	210	210	210	240	155	640	315	.....
12	70	240	275	210	210	210	460	275	.....
13	70	240	210	180	210	360	360	315	.....
14	90	410	180	155	180	240	710	275	.....
15	110	575	210	155	155	210	640	275	.....
16	130	460	240	210	155	240	515	240	.....
17	150	315	275	180	155	155	460	275	.....
18	180	275	315	180	130	130	360	240	.....
19	275	275	1,570	155	130	130	360	275	.....
20	360	240	1,340	155	105	105	315	210	.....
21	410	210	780	180	130	70	275	240	.....
22	640	210	640	180	105	70	315	240	.....
23	410	210	575	210	105	70	360	275	.....
24	1,060	180	410	180	105	55	360	240	.....
25	1,060	210	460	210	85	55	360	275	.....
26	920	275	410	360	85	55	315	240	.....
27	850	515	460	850	85	55	360	210	.....
28	710	640	410	2,330	85	45	240	180	.....
29	640	460	360	1,420	70	45	275	210	.....
30	575	515	460	1,060	70	35	210	155	.....
31	515	.....	360	.....	55	35	.....	180	.....

NOTE.—Daily discharge determined from a rating curve fairly well defined below 850 second-feet. Discharge interpolated for days for which gage heights are missing.

Monthly discharge of Milk River at Havre, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March	1,060	.....	330	20,300	C.
April	640	155	329	19,600	B.
May	1,570	155	416	25,600	B.
June	2,330	155	394	23,400	B.
July	1,420	55	313	19,200	B.
August	360	35	115	7,070	B.
September	2,980	35	664	39,500	B.
October	640	155	281	17,300	B.
November	180	.....	97	5,770	C.
December	.....	.....	[a] 40	2,460	D.
The period	.....	.....	.....	180,000	

[a] Estimated.

NOTE.—Discharge Nov. 8 to 30 estimated at 75 second-feet per day.

MILK RIVER AT MALTA, MONT.

Location.—In the NW. ¼ sec. 17, T. 30 N., R. 30 E., at the highway bridge at Malta, Mont.

Records available.—July 31, 1902, to December 31, 1911.

Drainage area.—About 14,000 square miles.

Gage.—Chain fastened to handrail on downstream side of bridge; datum unchanged.

Channel.—Sandy; shifts during floods.

Discharge measurements.—Made from bridge or by wading.

Winter flow.—More or less ice present during winter months.

Diversions.—The entire run-off from the drainage area above does not pass the station, for between Havre and Malta seven irrigation canals, which irrigate about 25,000 acres of land, divert water from Milk River and its tributaries. The United States Reclamation Service has under construction a diversion dam at Dodson about 17 miles above the station, which will divert water for the irrigation of about 108,000 acres of land in Milk River valley. East of Malta there are two canals, one on each side, the combined discharge being 1,000 second-feet.

Discharge measurements of Milk River at Malta, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 14	J. C. Beebe	1.75	155	July 1	J. C. Beebe	4.38	1,560
29	do	1.62	115	2	do	4.13	1,380
May 18	do	1.47	67	3	do	3.56	972
June 13	do	2.05	208	31	do	1.24	34
30	do	1.02	17.9	Oct. 10	W. A. Lamb	2.98	557

Daily gage height, in feet, of Milk River at Malta, Mont., for 1911.

[H. P. Clark, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.35	1.27	2.75	4.4	1.20	1.20	2.75	.....
2	.....	2.45	2.40	2.60	3.9	1.13	1.15	2.70	1.80
3	.....	2.25	2.40	2.55	3.35	1.10	1.15	2.70	.....
4	.....	2.15	2.45	2.40	3.1	1.07	1.25	2.65	1.95
5	.....	2.05	2.35	2.35	3.5	1.05	1.45	2.65	2.15
6	.....	1.95	2.20	2.25	3.45	1.05	5.2	2.70	.....
7	.....	1.90	2.05	2.25	2.95	1.03	7.0	2.85	1.55
8	.....	1.85	1.95	2.30	2.85	1.80	10.2	2.80	.....
9	.....	1.75	1.83	2.15	2.85	0.97	12.3	2.95	.....
10	.....	1.75	1.75	2.05	2.75	1.00	12.8	3.05	.....
11	.....	1.75	.....	2.00	2.50	0.97	11.4	2.85	.....
12	.....	1.75	.....	2.00	2.10	1.03	8.4	2.70	.....
13	.....	1.85	1.50	2.00	1.90	1.10	6.2	2.70	.....
14	.....	1.75	1.50	1.90	1.57	1.15	5.0	2.65	.....
15	.....	1.70	1.50	1.80	1.35	1.15	4.5	2.65	.....
16	.....	1.70	1.47	1.67	1.30	1.70	4.4	2.55	.....
17	.....	1.70	1.40	1.50	1.27	2.00	4.0	2.55	.....
18	.....	1.55	1.57	1.27	1.20	2.07	3.75	2.45	.....
19	.....	1.55	1.63	1.20	1.23	2.00	3.40	2.50	.....
20	.....	1.60	1.85	1.13	1.25	1.90	3.15	2.35	.....
21	.....	1.45	1.80	1.10	1.20	1.95	3.05	2.35	.....
22	.....	1.25	3.30	1.05	1.20	1.80	2.95	2.35	.....
23	.....	.....	3.45	.95	1.15	1.65	2.90	2.35	.....
24	.....	.....	3.10	1.65	1.25	1.63	2.75	2.30	.....
25	3.25	1.15	2.85	1.45	1.30	1.60	2.80	.....	.....
26	3.05	1.35	2.75	1.35	1.15	1.63	2.85	2.25	.....
27	2.65	1.45	3.90	1.25	1.10	2.05	3.15	2.30	.....
28	3.25	1.55	4.0	1.15	2.10	1.87	3.15	.....	.....
29	3.15	1.63	4.0	1.00	1.50	1.50	3.05	2.35	.....
30	2.25	1.63	3.35	3.20	1.30	1.35	2.90	.....	.....
31	1.75	.....	3.05	.....	1.25	1.33	.....	2.20	.....

Daily discharge, in second-feet, of Milk River at Malta, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	309	44	472	1,540	36	36	472	199
2	.....	346	327	405	1,210	29	31	448	141
3	.....	274	327	385	825	26	31	448	161
4	.....	241	346	327	660	24	42	426	181
5	.....	210	309	309	930	22	68	426	241
6	.....	181	257	274	895	22	2,100	448	164
7	.....	167	210	274	572	20	3,320	520	86
8	.....	154	181	291	520	141	5,250	495	.....
9	.....	129	149	241	520	16	6,540	572	.....
10	.....	129	129	210	472	18	6,860	630	.....
11	.....	129	112	195	365	16	5,980	520	.....
12	.....	129	94	195	225	20	4,160	448	.....
13	.....	154	76	195	167	26	2,780	448	.....
14	.....	129	76	167	89	31	1,960	426	.....
15	.....	117	76	141	54	31	1,620	426	.....
16	.....	117	71	110	47	117	1,540	385	.....
17	.....	117	60	76	44	195	1,280	385	.....
18	.....	86	89	44	36	216	1,100	346	.....
19	.....	86	102	36	39	195	860	365	.....
20	.....	95	154	29	42	167	692	309	.....
21	.....	68	141	26	36	181	630	309	.....
22	.....	42	790	22	36	141	572	309	.....
23	.....	39	895	15	31	106	545	309	.....
24	.....	35	660	106	42	102	472	291	.....
25	758	31	520	68	47	95	495	282	.....
26	630	54	472	54	31	102	520	274	.....
27	426	68	1,210	42	26	210	692	291	.....
28	758	86	1,280	31	225	159	692	300	.....
29	692	102	1,280	18	76	76	630	309	.....
30	274	102	825	725	47	54	545	283	.....
31	129	.....	630	.....	42	51	.....	257	.....

NOTE.—Daily discharge determined from a rating curve well defined below 2,500 second-feet. Discharge interpolated for days for which gage heights are missing.

Monthly discharge of Milk River at Malta, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March	758	129	246	15,100	C.
April	346	31	131	7,800	B.
May	1,280	44	384	23,600	B.
June	725	15	183	10,900	B.
July	1,540	26	319	19,600	B.
August	216	16	85.3	5,240	B.
September	6,860	31	1,730	103,000	C.
October	630	257	392	24,100	B.
November	199	.....	104	6,190	C.
December	.....	.....	[a] 50	3,070	D.
The period	.....	.....	.....	219,000	

[a] Estimated.

NOTE.—Discharge estimated Mar. 1 to 24 at 165 second-feet per day. Nov. 8 to 30 at 85 second-feet.

MILK RIVER NEAR HINSDALE, MONT.

Location.—At the highway bridge over Milk River about 1 mile from Hinsdale, Mont., a point 46 miles from the junction of Milk River with the Missouri.

Records available.—May 13, 1908, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Chain fastened to upstream side of highway bridge; datum unchanged.

Discharge measurements.—Made from bridge or by wading.

Winter flow.—Stream frozen entirely across and to a considerable depth from late in November until the first of April.

Diversions.—No water is diverted between the station at Hinsdale and that at Malta. The flow of the stream has, however, been appropriated by the United States Reclamation Service in connection with the Milk River project, and will be diverted at a point 9 miles east of Hinsdale to irrigate land in lower Milk River valley.

Discharge measurements of Milk River near Hinsdale, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 15	J. C. Beebe	3.48	775	July [a] 2	J. C. Beebe	3.06	633
20	.....do	2.92	480	2	.....do	4.51	1,400
May 17	.....do	2.00	180	Oct. 9	W. A. Lamb	4.06	1,020
June 16	.....do	2.42	254				

[a] Water just beginning to rise. Measurement of no use for discharge curve.

Daily gage height, in feet, of Milk River near Hinsdale, Mont., for 1911.

[Goldie Wooldridge, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.6	2.5	3.95	2.6	2.1	1.6	5.7	2.6
2	.....	3.7	2.45	3.9	4.4	1.7	1.55	8.2	2.6
3	.....	3.25	2.7	3.25	4.6	1.3	1.55	9.1	2.55
4	.....	3.3	2.8	3.25	4.2	1.3	1.35	14.6	2.55
5	.....	3.45	2.8	3.25	4.2	1.3	8.15	9.4	2.5
6	.....	3.35	2.75	3.25	4.1	1.3	10.8	6.1	2.5
7	.....	3.4	2.7	3.25	3.9	1.2	20.2	5.4	2.45
8	.....	3.35	2.7	3.2	3.4	1.2	18.2	4.3	.....
9	.....	3.4	2.55	3.05	3.4	1.2	16.6	4.0	.....
10	.....	3.25	2.3	2.85	3.2	1.1	14.4	3.9	.....
11	.....	3.35	2.35	2.55	2.9	1.1	12.1	3.7	.....
12	.....	3.4	2.4	2.55	2.6	1.0	11.3	3.6	.....
13	.....	3.25	2.2	2.75	2.35	1.5	9.5	3.4	.....
14	.....	3.3	2.0	2.55	2.25	1.3	9.6	3.3	.....
15	.....	3.45	2.05	2.55	2.05	1.3	8.2	3.25	.....
16	.....	3.85	2.05	2.35	2.05	1.2	6.8	3.2	.....
17	.....	4.15	2.0	2.15	2.05	1.2	6.5	3.15	.....
18	.....	3.85	2.0	2.15	2.55	1.2	5.9	3.1	.....
19	.....	3.15	2.0	2.15	2.35	1.2	5.1	3.0	.....
20	.....	2.9	1.7	2.15	1.85	2.3	4.7	3.0	.....
21	2.95	2.9	1.7	2.15	1.35	2.0	4.5	2.9	.....
22	3.0	2.9	1.55	2.15	1.25	1.95	4.1	2.9	.....
23	3.65	3.0	1.8	.....	1.35	1.95	3.7	2.9	.....
24	4.0	3.0	2.15	2.3	1.35	1.85	3.7	2.9	.....
25	3.65	2.95	2.15	6.6	1.35	1.75	3.6	2.9	.....
26	3.65	2.8	2.9	4.6	1.45	1.7	3.5	2.8	.....
27	4.0	2.7	3.3	3.3	1.35	1.65	3.2	2.8	.....
28	4.15	2.6	3.95	3.1	1.35	1.65	3.1	2.75	.....
29	4.2	2.55	6.0	2.85	1.35	1.55	3.3	2.7	.....
30	3.65	2.5	5.95	2.7	2.45	1.45	3.6	2.6	.....
31	3.7	.....	5.2	.....	2.35	1.7	.....	2.5	.....

Daily discharge, in second-feet, of Milk River near Hinsdale, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	825	315	1,020	355	177	63	2,170	330
2	.....	880	298	990	1,300	78	56	4,130	330
3	.....	640	395	640	1,430	32	56	4,850	312
4	.....	665	435	640	1,170	32	36	9,250	312
5	.....	742	435	640	1,170	32	4,090	5,090	295
6	.....	690	415	640	1,110	32	6,210	2,470	295
7	.....	715	395	640	990	24	13,700	1,940	276
8	.....	690	395	615	715	24	12,100	1,180	.....
9	.....	715	335	542	715	24	10,800	1,000	.....
10	.....	640	245	455	615	18	9,090	940	.....
11	.....	690	262	335	475	18	7,250	830	.....
12	.....	715	280	335	355	13	6,610	775	.....
13	.....	640	210	415	262	50	5,170	675	.....
14	.....	665	147	335	228	32	5,250	625	.....
15	.....	742	162	335	162	32	4,130	602	.....
16	.....	962	162	262	162	24	3,010	580	.....
17	.....	1,140	147	194	162	24	2,770	558	.....
18	.....	962	147	194	335	24	2,320	535	.....
19	.....	590	147	194	262	24	1,740	490	.....
20	.....	475	78	194	108	245	1,460	490	.....
21	498	475	78	194	36	147	1,320	450	.....
22	520	475	56	194	28	134	1,060	450	.....
23	852	520	97	220	36	134	830	450	.....
24	1,050	520	194	245	36	108	830	450	.....
25	852	498	194	2,850	36	88	775	450	.....
26	852	435	475	1,430	45	78	725	410	.....
27	1,050	395	665	665	36	70	580	410	.....
28	1,140	355	1,020	565	36	70	535	390	.....
29	1,170	335	2,400	455	36	56	625	370	.....
30	852	315	2,360	395	298	45	775	330	.....
31	880	.....	1,830	.....	262	78	.....	295	.....

NOTE.—Daily discharge determined as follows: Mar. 21 to Sept. 6, well-defined rating curve; Sept. 7 to Nov. 7, from poorly defined curve.

Monthly discharge of Milk River near Hinsdale, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March	.....	.....	507	31,200	C.
April	1,140	315	637	37,900	A.
May	2,400	56	477	29,300	A.
June	2,850	194	561	33,400	A.
July	1,430	28	418	25,700	A.
August	245	13	63.5	3,900	A.
September	13,700	36	3,470	206,000	C.
October	9,250	295	1,410	86,700	C.
November	.....	.....	220	13,100	D.
December	.....	.....	[a] 50	3,070	D.
The period	.....	.....	.....	470,000	

[a] Estimated.

NOTE.—Discharge Mar. 1 to 20 estimated at 300 second-feet per day; Nov. 8 to 30 estimated at 150 second-feet.

NORTH FORK OF MILK RIVER NEAR BROWNING, MONT.

Location.—At Alexander Dubray's ranch, 35 miles north of Browning, and about 2 miles south of the Canadian boundary line.

Records available.—May 8, 1911, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff gage nailed to a post on right bank.

Channel.—Liable to shift.

Discharge measurements.—Made by wading at convenient sections near the gage.

Winter flow.—Stream freezes over during the winter; winter gage heights have no value.

Accuracy.—Results are only fair. Estimates of daily and monthly discharge are not published, as no high-water measurements have been made.

Discharge measurements of North Fork of Milk River near Browning, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 8	B. E. Jones	4.93	31	June 25	W. A. Lamb	5.12	54
9	do	4.97	34	Aug. 28	B. E. Jones	4.74	20
June 8	do	4.87	30				

Daily gage height, in feet, of North Fork of Milk River near Browning, Mont, for 1911.

[B. F. Lowry, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	5.0	5.0	4.85	4.5	4.9	4.9
2	.....	4.95	4.9	4.85	4.55	4.9	4.9
3	.....	4.95	4.9	4.85	5.1	4.9	4.9
4	.....	4.9	4.9	4.85	5.45	4.9	4.9
5	.....	4.9	4.85	4.93	6.9	4.9	4.9
6	.....	4.95	4.85	4.9	6.9	4.9	4.9
7	.....	4.9	4.7	4.95	6.85	4.9	4.9
8	4.95	4.85	4.7	4.95	6.8	4.9	.....
9	5.0	4.95	4.7	5.0	5.8	4.9	.....
10	4.93	4.8	4.7	4.95	5.75	4.9	.....
11	4.9	4.8	4.7	4.85	5.65	4.9	.....
12	4.95	4.8	4.65	4.7	4.9	4.9	.....
13	5.0	4.85	4.65	4.7	4.9	4.9	.....
14	5.1	4.8	4.6	4.7	4.9	4.9	.....
15	6.25	4.8	4.6	4.65	4.9	4.9	.....
16	5.35	4.8	4.6	4.6	4.9	4.9	.....
17	5.0	4.8	4.7	4.6	4.9	4.9	.....
18	5.1	4.8	4.75	4.6	4.9	4.9	.....
19	5.0	4.8	4.75	4.55	4.9	4.9	.....
20	4.95	4.8	4.8	4.55	4.9	4.9	.....
21	4.95	4.8	4.8	4.55	5.1	4.9	.....
22	4.95	4.85	4.8	4.5	5.1	4.9	.....
23	5.0	5.0	4.75	4.5	4.9	4.9	.....
24	5.0	5.1	4.75	4.5	4.9	4.9	.....
25	5.05	5.1	4.7	4.55	4.9	4.9	.....
26	5.05	5.15	4.7	4.55	4.9	4.9	.....
27	5.0	5.15	4.65	4.5	4.9	4.9	.....
28	4.95	5.1	4.65	4.55	4.9	4.9	.....
29	4.9	5.05	4.7	4.55	4.9	4.9	.....
30	4.9	5.05	4.95	4.5	4.9	4.9	.....
31	4.95	.....	4.85	4.5	.....	4.9	.....

NORTH FORK OF MILK RIVER NEAR CHINOOK, MONT.

Location.—In sec. 3, T. 33 N., R. 19 E., at a point about 4½ miles north of Chinook, Mont., about 7 miles above the junction of the North Fork with the main stream.

Records available.—April 22, 1905, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Chain on the left bank near the house of the observer.

Channel.—Sandy and shifting.

Discharge measurements.—Made by wading or at the cable near the gage.

Winter flow.—Ice present; gage readings impracticable.

Diversions.—Three canals, which divert in the aggregate about 20 second-feet, take out above the station; several small pumping plants, which supply water for irrigating the bottom land along the river valley, also operate above the station. Below the station the Matheson and Cook canals divert water for irrigating land in Milk River Valley near the mouth of the North Fork. The aggregate appropriation for these canals is 78 second-feet.

Accuracy.—Results may be considered reliable as a fair rating curve has been constructed. The greater part of the run-off occurs during floods caused by heavy rains in the spring and early summer. In the fall the channel is often dry.

Discharge measurements of North Fork of Milk River near Chinook, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 11	J. C. Beebe	0.80	34	May 27	J. C. Beebe	0.89	41
22	do	1.83	190	June 12	do	.46	9.9
May 1	do	1.19	63	20	do	.29	3.4
8	do	1.24	79	26	do	.23	2.0
12	do	1.06	59	July 8	do	.27	3.5
22	do	.70	24	Oct. 12	W. A. Lamb	.80	44

Daily gage height, in feet, of North Fork of Milk River near Chinook, Mont., for 1911.

[Mrs. R. B. Snedecor, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Sept.	Oct.	Nov.
1		1.36	1.12	0.82	0.20		0.90	0.62
2		1.18	1.08	.85	.19		.94	.64
3		1.08	1.02	.84	.18		.91	.66
4		1.02	1.00	.82	.18	0.85	.88	.68
5		.95	1.05	.78	.16	4.6	.84	.70
6		1.00	1.05	.72	.15	9.6	.81	.71
7		.92	1.05	.70	.15	10.0	.80	.72
8		.72	1.20	.68	.35	5.8	.84	.72
9		.86	1.20	.59	.48	4.2	.85	.72
10		.80	1.19	.54	.51	3.2	.85	.72
11		.85	1.16	.50	.45	2.60	.84	.72
12		.89	1.08	.50	.34	2.20	.81	
13		.92	.96	.48	.28	1.85	.80	
14		.99	.91	.45	.24	1.65	.79	
15		.96	.95	.44	.20	1.45	.78	
16		1.50	1.04	.42	.19	1.28	.76	
17		1.60	1.08	.41	.16	1.18	.74	
18		1.39	.91	.38	.15	1.12	.72	
19		1.22	.88	.30	.14	1.08	.70	
20		1.20	.81	.29	.11	.99	.70	
21		1.60	.76	.28	.08	.92	.72	
22		1.90	.74	.26		.94	.74	
23	0.55	1.60	.79	.25		.98	.74	
24	.61	1.70	.81	.24		1.65	.72	
25	.52	1.50	.84	.23		2.00	.70	
26	.70	1.60	.90	.22		1.90	.69	
27	.90	1.32	.90	.20		1.80	.68	
28	.85	1.30	.88	.19		1.60	.66	
29	1.25	1.28	.86	.18		1.30	.65	
30	1.28	1.20	.85	.20		.95	.64	
31	1.40		.84				.62	

Daily discharge, in second-feet, of North Fork of Milk River near Chinook, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Sept.	Oct.	Nov.
1	.....	95	64	35	2.0	0	52	29
2	.....	72	60	37	1.9	0	56	31
3	.....	60	53	36	1.8	0	53	32
4	.....	53	51	35	1.8	48	50	34
5	.....	46	56	31	1.6	1,040	47	35
6	.....	51	56	27	1.5	3,060	44	36
7	.....	43	56	25	1.5	3,220	43	37
8	.....	27	74	24	6	1,500	47	37
9	.....	38	74	18	12	895	48	37
10	.....	33	73	15	14	560	48	37
11	.....	37	69	13	10	392	47	37
12	.....	40	60	13	5.6	285	44	.....
13	.....	43	47	12	3.6	200	43	.....
14	.....	50	42	10	2.8	156	42	.....
15	.....	47	46	10	2.0	120	41	.....
16	.....	117	55	9	1.9	94	40	.....
17	.....	135	60	8.5	1.6	82	38	.....
18	.....	100	42	7.2	1.5	74	37	.....
19	.....	77	39	4.0	1.4	70	35	.....
20	.....	74	34	3.8	1.1	60	35	.....
21	.....	135	30	3.6	.8	54	37	.....
22	.....	206	28	3.2	0	56	38	.....
23	16	135	32	3.0	0	59	38	.....
24	19	156	34	2.8	0	156	37	.....
25	14	117	36	2.6	0	235	35	.....
26	25	135	41	2.4	0	211	34	.....
27	41	90	41	2.0	0	188	34	.....
28	37	87	39	1.9	0	146	32	.....
29	80	84	38	1.8	0	97	32	.....
30	84	74	37	2.0	0	56	31	.....
31	101	.....	36	.....	0	.....	29	.....

NOTE.—Daily discharge determined from rating curves as follows: Mar. 23 to July 21, fairly well defined below 115 second-feet; Sept. 4 to Nov. 11, poorly defined.

Monthly discharge of North Fork of Milk River near Chinook, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 0	0	
February	.....	.....	[a] 0	0	
March	101	.....	19.1	1,170	C.
April	206	27	81.9	4,870	B.
May	74	28	48.5	2,980	B.
June	37	1.8	13.3	791	B.
July	14	0	2.46	151	B.
August	0	0	0.0	0	
September	3,220	0	437	26,000	C.
October	56	29	40.9	2,510	C.
November	37	.....	28.6	1,700	C.
December	.....	.....	[a] 10.0	615	
The year	3,220	0	56.4	40,800	

[a] Estimated.

NOTE.—Discharge Mar. 1 to 22 estimated at 8 second-feet per day; Nov. 12 to 30, 25 second-feet. Stream dry July 22 to Sept. 3.

BEAVER CREEK NEAR SACO,[1] MONT.

Location.—In sec. 35, T. 31 N., R. 32 E., at Craig's ranch, 3 miles south of Ashfield, Mont., near Saco, the nearest post office, and about 18 miles from Malta.

Records available.—July 5, 1903, to November 4, 1911.

[1] Station described in earlier reports as "Beaver Creek near Ashfield, Mont."

Drainage area.—Not measured.

Gage.—Staff. The gage was first established at bridge No. 455 of the Great Northern Railway, half a mile west of Ashfield; it was moved to its present location, 2½ miles farther upstream, December 31, 1903.

Channel.—The stream carries little water except at the times of the spring floods or heavy rains; during the summer months the channel is obstructed by a dense growth of weeds and willows, which have to be cleared out occasionally. At medium and high stages a second channel, known as Beaver Creek Overflow, receives the stream above the station, fills a depression to the west of the main channel, and reenters at a point some distance below the gage.

Discharge measurements.—Made from a cable or by wading.

Winter flow.—Ice present during the winter months.

Diversions.—Water is diverted from Beaver Creek by small ditches leading from the stream and by small pumping plants near the banks.

Accuracy.—Results are only fair, as the growth of weeds and willows in the channel makes the construction of a permanent rating curve difficult. Daily discharge given for days with gage heights only; no monthly estimates have been made.

Discharge measurements of Beaver Creek near Saco, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 14	J. C. Beebe	2.42	15.8	June 30	J. C. Beebe	4.09	79
June 13	do	2.39	19.8	July 31	do	2.78	31
24	do	3.00	39	Oct. 10	W. A. Lamb	3.40	61

Daily gage height, in feet, of Beaver Creek near Saco, Mont., for 1911.

[Mrs. W. P. Craig, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1						2.50		1.90	1.55
2						2.25		1.80	1.55
3						2.15		2.50	1.55
4						2.00		2.95	1.55
5						1.90	2.10	3.9	
6						1.85	3.25	4.8	
7						1.75	4.3		
8						1.70	9.6		
9		2.32				1.65	10.2		
10		2.22					9.8	3.20	
11		2.07					8.2	2.75	
12		2.02					7.5	2.55	
13				2.38			7.2	2.35	
14		2.42		2.23			6.4	2.15	
15				2.13			6.0	2.00	
16				2.08			5.6	2.00	
17				2.08			5.2	2.00	
18				1.98			4.8	2.00	
19				1.98			4.2	2.00	
20				1.98			3.8	1.90	
21				1.98			3.35	1.90	
22				1.88			3.05	1.90	
23	5.7			1.88			2.90	1.90	
24	4.9			3.00			2.85	1.80	
25	4.1			2.12			2.70	1.75	
26	3.8			3.15			2.45	1.60	
27	3.6			4.8			2.30	1.60	
28	3.40		3.90	6.6	2.95		2.20	1.60	
29	3.10		9.00	5.3	3.10		2.15	1.60	
30	2.75		11.40	4.0	3.15		1.95	1.60	
31	2.70		12.00		2.90			1.60	

Daily discharge, in second-feet, of Beaver Creek near Saco, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1						21		6.0	0.5
2						14		4.0	.5
3						11		21	.5
4						8.0		37	.5
5						6.0	10	77	
6						5.0	49	122	
7						3.2	97		
8						2.5	438		
9		16				1.8	486		
10		13					454	47	
11		9.0					339	29	
12		8.4					290	22	
13				17			269	16	
14		19		13			214	11	
15				11			190	8.0	
16				9.6			166	8.0	
17				9.6			142	8.0	
18				7.6			122	8.0	
19				7.6			92	8.0	
20				7.6			72	6.0	
21				7.6			53	6.0	
22				5.4			41	6.0	
23	172			5.4			35	6.0	
24	127			39			33	4.0	
25	87			10			27	3.2	
26	72			45			20	1.0	
27	63			122			15	1.0	
28	55		77	227	37		12	1.0	
29	43		395	148	43		11	1.0	
30	29		582	82	45		7	1.0	
31	27		630		35			1.0	

BEAVER CREEK OVERFLOW NEAR BOWDOIN, MONT.

Location.—In the SW. ¼ sec. 17, T. 30 N., R. 32 E., at John Turmell's ranch, 14 miles from Malta, Mont.

Records available.—June 29, 1903, to August 30, 1906; May 2, 1908, to December 31, 1910; March 20 to November 11, 1911.

Gage.—Staff; datum unchanged.

Channel.—Water flows in this channel only when Beaver Creek is high; during the remainder of the season the water is standing in pools and fluctuations in water level are due wholly to local rains and to evaporation.

Discharge measurements.—At flood stages made at a bridge half a mile below the gage; low-water measurements are made by wading near the gage.

Accuracy.—Records poor. Lack of measurements in 1911 has prevented the making of estimates of daily and monthly discharge.

Discharge measurements of Beaver Creek overflow near Bowdoin, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 13	J. C. Beebe	4.46	0
Oct. 10	W. A. Lamb	4.47	10

Daily gage height, in feet, of Beaver Creek overflow near Bowdoin, Mont., for 1911.

[Henry Turmell, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.8	3.1	9.0	4.9	4.1	3.1	3.7	3.5
2	.....	3.7	3.1	7.9	4.8	4.0	3.0	3.6	3.5
3	.....	3.7	3.0	6.8	4.7	3.9	3.0	4.4	3.4
4	.....	3.6	3.0	6.6	4.5	3.8	3.0	4.7	3.4
5	.....	3.5	3.0	5.3	4.3	3.8	3.0	4.1	3.4
6	.....	3.5	3.0	4.8	4.1	3.7	3.3	5.7	3.4
7	.....	3.5	2.9	4.3	3.8	3.7	4.1	5.5	3.4
8	.....	3.4	2.9	4.2	3.8	3.7	7.1	4.9	3.4
9	.....	3.5	2.9	4.2	3.7	3.6	9.2	4.7	3.4
10	.....	3.5	2.9	4.1	3.6	3.5	9.1	4.4	3.3
11	.....	3.6	2.9	4.0	3.6	3.5	9.1	4.3	3.3
12	.....	3.6	2.8	4.3	3.6	3.5	9.1	4.1	.....
13	.....	3.6	2.8	4.5	3.5	3.4	8.4	3.9	.....
14	.....	3.7	2.8	4.5	3.5	3.4	7.9	3.8	.....
15	.....	3.8	2.8	4.4	3.3	3.4	6.5	3.8	.....
16	.....	4.0	2.8	4.3	3.3	3.4	6.3	3.7	.....
17	.....	3.9	2.8	4.1	3.3	3.4	6.1	3.7	.....
18	.....	3.7	2.7	4.0	3.2	3.4	5.8	3.7	.....
19	.....	3.5	2.7	3.8	3.2	3.4	5.4	3.7	.....
20	2.4	3.4	2.7	3.8	3.2	3.3	5.0	3.6	.....
21	2.4	3.4	2.7	3.8	3.1	3.3	4.9	3.6	.....
22	4.2	3.4	2.7	3.7	3.1	3.3	4.7	3.6	.....
23	5.2	3.4	2.7	3.7	3.1	3.3	4.5	3.6	.....
24	5.1	3.4	2.7	6.5	3.1	3.3	4.3	3.6	.....
25	4.9	3.4	2.7	6.0	3.1	3.2	4.1	3.5	.....
26	4.5	3.3	2.8	8.1	3.0	3.2	4.0	3.5	.....
27	4.4	3.3	2.8	7.1	3.0	3.2	3.9	3.5	.....
28	4.3	3.3	4.7	5.7	3.0	3.1	3.8	3.5	.....
29	4.1	3.2	8.6	5.3	2.9	3.1	3.7	3.5	.....
30	4.0	3.1	9.0	4.8	4.3	3.1	3.7	3.5	.....
31	3.9	.....	9.2	.....	4.3	3.1	.....	3.5	.....

PORCUPINE CREEK AT NASHUA, MONT.

Location.—In the center of the NW. ¼ sec. 25, T. 28 N., R. 40 E., at the road crossing at Nashua, Mont.

Records available.—July 11, 1908, to October 31, 1911.

Drainage area.—Not measured.

Gage.—Staff, nailed to tree on right bank at the road crossing.

Channel.—Dry in late summer and in winter.

Discharge measurements.—Made by wading near gage.

Diversions and storage.—The water of this stream is neither diverted nor stored.

Discharge measurements of Porcupine River at Nashua, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 19	J. C. Beebe	3.61	14.5
May 16	.....do	3.20	1.5
June 15	.....do	3.01	0.4
Oct. 8	W. A. Lamb	5.55	82

Daily gage height, in feet, of Porcupine Creek at Nashua, Mont., for 1911.

[Mrs. B. H. Burger, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Sept.	Oct.	Nov.
1	.....	2.0	3.3	3.45	2.7	.....	3.8	4.0
2	.....	2.0	3.3	3.4	2.6	.....	3.8	3.[illegible]
3	.....	2.0	3.25	3.5	2.6	.....	4.0	.....
4	.....	1.9	3.25	3.45	2.5	.....	.....	.....
5	.....	1.9	3.25	3.4	2.5	.....	.....	.....
6	.....	2.0	3.25	3.3	2.5	8.0	8.1	.....
7	.....	2.0	3.2	3.3	2.5	.....	6.4	.....
8	.....	2.0	3.2	3.25	2.4	.....	5.3	.....
9	.....	1.9	3.2	3.2	.....	9.0	5.1	.....
10	.....	1.9	3.2	3.15	.....	7.6	4.9	.....
11	.....	4.5	3.15	3.1	.....	6.0	4.6	.....
12	.....	3.5	3.15	3.1	.....	5.2	4.4	.....
13	.....	4.3	3.15	3.05	.....	4.8	4.3	.....
14	.....	3.4	3.15	3.05	.....	.....	4.2	.....
15	.....	3.1	3.1	3.05	.....	.....	4.2	.....
16	.....	.....	3.2	3.0	.....	7.0	4.1	.....
17	.....	.....	3.2	3.0	.....	6.0	4.0	.....
18	.....	.....	3.2	3.0	.....	5.2	4.0	.....
19	2.4	.....	3.1	2.95	.....	4.8	3.9	.....
20	2.4	3.6	3.1	2.95	.....	4.6	3.8	.....
21	2.3	3.6	3.1	2.9	.....	4.4	3.8	.....
22	2.3	3.7	3.1	2.9	.....	4.2	3.8	.....
23	2.3	3.6	3.1	2.9	.....	4.2	3.8	.....
24	2.2	3.45	3.2	2.85	.....	4.2	3.8	.....
25	2.2	3.4	3.2	2.8	.....	4.1	3.8	.....
26	2.0	3.4	3.25	2.8	.....	4.0	3.8	.....
27	2.2	3.35	3.3	2.65	.....	3.9	3.7	.....
28	2.4	3.3	3.7	2.5	.....	3.8	3.7	.....
29	2.3	3.3	3.6	2.5	.....	3.8	3.7	.....
30	2.2	3.25	3.6	2.6	.....	3.8	3.7	.....
31	2.1	.....	3.6	.....	.....	.....	3.7	.....

Daily discharge, in second-feet, of Porcupine Creek at Nashua, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	Sept.	Oct.	Day.	Mar.	Apr.	May.	June.	Sept.	Oct.
1	.....	1.0	4.0	7.8	0	18	16	.....	25	2.0	0.5	142	28
2	.....	1.0	4.0	6.5	0	18	17	.....	22	2.0	.5	101	24
3	.....	1.0	3.0	9.0	0	24	18	.....	19	2.0	.5	68	24
4	.....	.5	3.0	7.8	0	347	19	8.5	16	1.0	.2	52	21
5	.....	.5	3.0	6.5	0	265	20	8.5	12	1.0	.2	45	18
6	.....	1.0	3.0	4.0	183	187	21	6.0	12	1.0	.0	38	18
7	.....	1.0	2.0	4.0	347	117	22	6.0	15	1.0	.0	31	18
8	.....	1.0	2.0	3.0	347	72	23	6.0	12	1.0	.0	31	18
9	.....	5	2.0	2.0	224	64	24	4.0	7.8	2.0	.0	31	18
10	.....	.5	2.0	1.5	167	56	25	4.0	6.5	2.0	.0	28	18
11	.....	83	1.5	1.0	101	45	26	1.0	6.5	3.0	.0	24	18
12	.....	43	1.5	1.0	68	38	27	4.0	5.2	4.0	.0	21	15
13	.....	74	1.5	.8	52	34	28	8.5	4.0	15	.0	18	15
14	.....	39	1.5	.8	265	31	29	6.0	4.0	12	.0	18	15
15	.....	28	1.0	.8	265	31	30	4.0	3.0	12	.0	18	15
							31	2.0	.....	12	.....	.....	15

NOTE.—Daily discharge determined from two rating curves that are fairly well defined, applicable Mar. 19 to Apr. 15 and Apr. 20 to Oct. 31, respectively.

Monthly discharge of Porcupine Creek at Nashua, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
Mar. 19-31	8.5	1.0	5.3	137	B.
April	83	.5	14.8	881	B.
May	15	1.0	3.48	214	B.
June	9.0	.0	1.95	116	B.
July	.0	.0	.00	0	
August	.0	.0	.00	0	
September	347	.0	89.5	5,330	B.
October	[a] 347	15	53.1	3,260	B.

[a] Maximum crest Oct. 4, 491 second-feet.

NOTE.—Stream dry June 21 to Sept. 5.

PRIVATE CANALS IN MILK RIVER VALLEY.

GENERAL FEATURES.

Since 1905 a number of stations have been maintained on private canals in Milk River valley for the purpose of ascertaining the extent of private water rights. With the exception of Rock Creek Canal, which is near Hinsdale, in Valley County, these canals are located in Chouteau County and are used to irrigate lands in the vicinity of Harlem and Chinook.

The canals are all built on small grades and in soil which is easily eroded. In many of them silt has been deposited, and nearly all of them contain a growth of weeds and moss. At low stages the water is uniformly sluggish. In order to divert water into the laterals checks are erected in the main canals, and these checks often produce back-water effects for long distances above. They were put up under a great variety of conditions, and as a result velocities are found to differ widely at the same gage height during the season. In order to establish the correct relation between gage height and discharge it is necessary to make several rating curves for the same canal station. Frequent discharge measurements are necessary to obtain reliable results. Staff gages are located on all canals and most measurements are made by wading.

PARADISE VALLEY CANAL NEAR CHINOOK, MONT.

Location.—Near the head gate at Rudolph Friede's ranch; reached by driving along the south river road from Chinook.

Records available.—June, 1903, to August 31, 1911.

Discharge measurements.—Made by wading.

Discharge measurements of Paradise Valley canal near Chinook, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 24	J. C. Beebe	1.41	11.2	June 11[a]	J. C. Beebe	1.25	15.9
May 2	do	1.38	12	22	do	0.91	0.5
9	do	1.51	15.7	29	do	1.32	5.0
13	do	1.77	21	July 5	do	1.30	3.0
20	do	1.42	8.6	28	do	1.32	1.8
26	do	1.25	5.3	Aug. 1	do	1.71	7.1

[a] Gage height distorted by changing stage.

Daily gage height, in feet, and discharge, in second-feet, of Paradise Valley canal near Chinook, Mont., for 1911.

[Rudolph Friede, observer.]

Day.	Apr.		May.		June.		July.		Aug.		Sept.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Dis. charge.	Gage height.	Discharge.	Gage height.	Discharge.
1			1.31	9.3	1.20	4.0	1.44	7.5	1.79	10		
2			1.31	9.3	1.20	4.0	1.25	3.8	1.66	6.0		
3			1.50	15	1.18	3.7	1.70	16	1.66	6.0		
4			1.51	15	1.20	4.0	1.60	12	1.57	3.9		
5			1.52	16	1.21	4.2	1.26	3.9	1.57	3.9	1.05	
6			1.50	15	1.20	4.0	1.41	6.8	1.56	3.7	1.29	
7			1.40	12	1.09	2.4	1.42	7.0	1.51	2.7	1.18	
8			1.19	6.9	1.21	4.2	1.08	1.3	1.59	4.3	0.79	
9			1.50	15	1.26	5.2	0.64	.0	1.58	4.1	0.52	
10			1.60	18	1.21	4.2	1.58	11	1.49	2.4	0.42	
11			1.58	13	1.25	5.0	1.82	21	1.33	.8	0.34	
12			1.49	11	1.57	13	1.72	17	1.19	0	0.31	
13			1.81	22	1.50	11	1.68	15	1.29	.4	0.30	
14			1.63	15	1.51	11	1.88	19	1.13	0	0.28	
15			1.72	19	1.36	7.2	1.72	12	1.15	0	0.26	
16			1.72	19	1.52	12	1.76	13	1.15	0	0.24	
17			1.71	18	1.52	12	1.64	9.2	1.12	0	0.24	
18			1.65	16	1.74	20	1.70	11	0.50	0	0.22	
19			1.74	20	1.52	12	1.76	13	0.43	0	0.20	
20			1.92	28	1.34	6.8	1.72	12	0.35	0		
21			1.38	7.6	0.96	.6	1.62	8.6	0.24	0		
22		5	1.45	9.5	0.92	.5	1.83	16	0.22	0		
23		11	1.42	8.6	1.17	3.6	1.65	9.5	0.20	0		
24	1.48	14	1.44	9.2	1.63	15	1.56	7.0		0		
25	1.50	15	1.27	5.4	1.70	18	1.56	7.0		0		
26	1.51	15	1.26	5.2	1.61	12	1.73	12		0		
27	1.50	15	1.22	4.4	2.04	32	1.58	7.5		0		
28	1.71	22	1.25	5.0	1.63	13	1.35	2.5		0		
29	1.72	23	1.24	4.8	1.85	22	1.45	4.5		0		
30	1.59	18	1.21	4.2	1.61	12	1.53	6.2		0		
31			1.21	4.2			1.69	11		0		

NOTE.—Daily discharge determined from a series of parallel curves. Discharge estimated Apr. 22 and 23.

Monthly discharge of Paradise Valley canal near Chinook, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 22-30	23	5	15.3	273
May	28	4.2	12.3	756
June	32	.5	9.29	553
July	21	.0	9.78	601
August	10	.0	1.55	95.3
The year				2,280

NOTE.—Canal head gates open Apr. 22 and closed Aug. 14. No flow Jan. 1 to Apr. 21 and Aug. 15 to Dec. 31.

COOK CANAL NEAR CHINOOK, MONT.

Location.—About half a mile above a small wooden highway bridge on the road running parallel to the Great Northern Railway, about 3 miles east of Chinook.

Records available.—April 10, 1905, to July 31, 1911.

Gage.—Staff.

Discharge measurements.—Made from highway bridge.

Discharge measurements of Cook canal near Chinook, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 12	John C. Beebe	2.19	23	May 26	John C. Beebe	3.98	35
23	do	3.97	51	June 11	do	3.16	12.8
May 2	do	3.89	39	22	do	2.17	2.8
9	do	2.16	1.3	29	do	2.43	3.4
13	do	3.88	42	July 5	do	1.75	.0
20	do	3.83	30				

Daily gage height, in feet, and discharge, in second-feet, of Cook canal near Chinook, Mont., for 1911.

[Adam Jamison, observer.]

Day.	April.		May.		June.		July.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			3.75	34	3.93	37	1.95	1.0
2			3.95	46	3.92	38	1.97	1.0
3			4.05	54	3.95	40	1.91	.8
4			3.88	42	3.92	38	1.83	.4
5			3.82	38	3.89	38	1.75	.2
6			3.90	43	3.75	30	1.65	.0
7			2.18	2.1	3.65	26	1.55	.0
8			2.15	2.0	3.50	22	1.50	.0
9			2.15	2.0	3.40	20	1.59	.0
10			2.20	2.2	3.30	17	2.00	1.2
11			2.13	1.8	3.20	15	2.45	3.8
12			3.98	49	3.00	11	2.43	3.6
13			3.88	42	2.95	10	2.29	2.7
14			3.95	44	2.85	8.8	2.15	2.0
15			3.95	42	2.75	7.2	2.01	1.2
16			3.85	35	2.62	5.8	1.81	.3
17			3.85	33	2.50	4.3	1.62	.0
18			3.85	32	2.35	3.1	1.55	.0
19			3.78	28	2.30	2.8	1.72	.1
20			3.72	25	2.25	2.5	1.70	.0
21			3.70	24	2.21	2.3	1.65	.0
22			3.65	22	2.23	2.4	1.50	.0
23	3.98	49	3.65	22	2.90	9.5	1.45	.0
24	4.00	50	3.85	30	2.20	2.2	1.30	.0
25	3.93	45	3.90	32	2.45	3.8	1.31	.0
26	3.85	40	3.95	34	2.52	4.5	1.25	.0
27	3.83	39	3.98	38	2.80	8.0	1.32	.0
28	4.02	52	3.98	38	2.78	7.7		
29	3.73	34	3.97	37	2.30	2.8		
30	3.75	34	4.07	47	2.09	1.6		
31			4.00	41				

NOTE.—Daily discharge determined from a series of parallel curves and the indirect method for shifting channels.

Monthly discharge of Cook canal near Chinook, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 30–31				[a] 15
April			[b] 42.9	[a] 1,900
May	54	1.8	31.0	1,910
June	40	1.6	14.0	833
July	3.8	0	.59	36
The year				4,690

[a] Estimated by ditch rider as follows: Mar. 30–31, 15 acre-feet. Apr. 1 to 22, 1,220 acre-feet.
[b] Mean Apr. 23 to 30.

NOTE.—Canal gates opened April 23 and closed July 17.

MATHESON CANAL NEAR CHINOOK, MONT.

Location.—At a footbridge 200 feet below the headgate of the canal near the main road, 3½ miles east of Chinook.

Records available.—April 10, 1905, to July 31, 1911.

Gage.—Staff.

Discharge measurements.—Made from footbridge or by wading.

Discharge measurements of Matheson canal near Chinook, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 12	J. C. Beebe	(a)	8.7	May 20	J. C. Beebe	3.10	2.71
14	do	3.6	9.3	26	do	2.90	3.8
May 2	do	3.19	5.9	June 11	do	2.70	[b] 1.3
9	do	3.42	7.1	22	do	2.29	[b] .5
13	do	3.00	4.5	28	do	2.32	1.8

[a] No gage. [b] Estimated.

Daily gage height, in feet, and discharge, in second-feet, of Matheson canal near Chinook, Mont., for 1911.

[Adam Jamison, observer.]

Day.	April.		May.		June.		July.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			3.35	7.2	3.15	5.6	2.30	1.7
2			3.15	5.6	3.12	5.4	2.25	1.5
3			3.25	6.4	3.10	5.2	2.21	1.3
4			3.25	6.4	3.15	5.6	2.15	1.2
5			3.18	5.8	3.13	5.4	2.21	1.3
6			3.15	5.6	3.09	5.1	2.25	1.5
7			3.50	7.8	3.11	5.3	2.21	1.3
8			3.48	7.6	2.93	4.0	2.19	1.3
9			3.42	7.2	2.95	4.2	2.15	1.2
10			3.47	7.6	2.70	2.5	2.20	1.3
11			3.45	7.4	2.65	2.2	2.51	2.6
12			3.20	6.0	2.71	2.6	2.50	2.6
13			3.01	4.6	2.48	1.2	2.39	2.1
14			2.95	4.2	2.40	.9	2.32	1.8
15			2.59	.9	2.31	.6	2.29	1.7
16			2.42	1.0	2.30	.6	2.30	1.7
17			3.32	4.4	2.30	.6	2.25	1.5
18			3.20	3.4	2.30	.6	2.20	1.3
19			3.15	3.0	2.30	.6	2.15	1.2
20			3.12	2.8	2.30	.6	2.25	1.5
21			2.95	1.7	2.20	.3	2.13	1.1
22			2.95	1.7	2.29	.6	2.15	1.2
23	3.65	9.8	2.89	3.7	2.21	.3	2.23	1.4
24	3.67	9.9	2.80	3.1	2.25	.4	2.30	1.7
25	3.50	8.4	2.75	2.8	2.25	.4	2.21	1.3
26	3.60	9.3	2.85	3.4	2.22	1.4	2.20	1.3
27	3.52	10.0	3.15	5.6	2.21	1.3		0
28	3.48	8.2	3.15	5.6	2.30	1.7		0
29	3.45	8.0	3.10	5.2	2.30	1.7		0
30	3.40	7.6	3.20	6.0	2.32	1.8		0
31			3.20	6.0				0

NOTE.—Daily discharge determinted from a series of parallel curves.

Monthly discharge of Matheson canal near Chinook, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 27-31				[a] 30
April			[b] 8.9	[a] 491
May	7.8	0.9	4.83	297
June	5.6	.3	2.29	136
July	2.6	.0	1.28	78.7

[a] Estimated by ditch rider as follows: Mar. 27-31, 30 acre-feet; Apr. 1-22, 350 acre-feet.
[b] Mean Apr. 23-30.

HARLEM CANAL NEAR ZURICH, MONT.

Location.—About 500 feet below the headgates of the canal, 1½ miles southeast of the Great Northern Railway section house at Zurich; reached by driving from Chinook.

Gage.—Staff.

Discharge measurements.—Made by wading.

Discharge measurements of Harlem canal near Zurich, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 12	J. C. Beebe	2.12	24	June 11	J. C. Beebe	1.61	33
24	do	3.79	67	22	do	2.79	33
May 2	do	3.85	70	29	do	3.31	50
9	do	3.70	69	July 5	do	3.14	40
13	do	3.94	82	8	do	1.78	5.2
20	do	3.90	72	Aug. 1	do	1.08	2.9
26	do	2.65	28				

Daily gage height, in feet, and discharge, in second-feet, of Harlem canal near Zurich, Mont., for 1911.

[Joel Lean, observer.]

Day.	March.		April.		May.		June.		July.		August.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			3.80	78	3.85	70	2.98	38	3.64	60	1.14	3
2			3.60	70	3.90	72		38	3.70	62	1.15	3
3			3.00	49	3.90	72		39	3.64	58	1.11	3
4			2.70	40	3.90	72	3.00	39	3.60	56	1.11	3
5			2.00	22	3.80	70	3.00	43	3.14	40	1.10	3
6			2.00	22	3.80	70	2.95	41	3.10	37	1.05	3
7			3.60	70	3.85	71	3.00	43	1.00	0	1.06	3
8			3.60	70	3.80	73	2.95	41	1.00	0	1.20	4
9			3.80	78	3.70	68	2.70	36	2.70	25	1.30	5
10			3.75	76	3.80	73	2.70	36	3.11	37	1.30	5
11			3.70	74	3.80	73	2.65	34	3.20	40	1.35	5
12			3.70	74	3.80	73	2.65	30	3.20	38	1.42	6
13			3.60	70	3.94	82	2.65	30	3.04	32	1.45	6
14			3.40	56	3.85	79	3.05	42	2.47	19	1.43	6
15			3.35	61	3.86	79	3.00	40	2.25	14	1.35	5
16			3.75	73	3.90	77	3.00	40	2.10	12	1.34	5
17			3.80	75	3.80	73	2.95	38	2.13	14	1.32	5
18			3.80	75	3.80	68	3.20	47	2.15	14	1.30	5
19	1.50	13	3.75	73	3.80	68	3.25	48	2.18	15	1.29	5
20	2.50	34	3.80	72	3.89	72	3.15	45	2.20	15	1.20	4
21	2.70	39	3.80	72	3.75	66	2.95	38	2.20	15	1.20	4
22	2.80	42	3.85	74	3.70	64	2.79	34	2.19	17	1.20	4
23	2.80	42	3.80	72	3.68	64	2.75	32	2.19	17		
24	2.90	46	3.80	69	3.60	61	3.00	40	2.20	17		
25	3.40	63	3.80	69	3.55	59	3.10	43	2.18	16		
26	3.40	63	3.85	71	2.65	30	3.60	61	2.00	13		
27	3.50	67	3.90	73	2.55	27	3.50	57	1.50	7		
28	3.70	74	3.90	72	2.60	31	3.46	56	1.29	5		
29	3.70	74	3.80	68	2.60	31	3.31	50	1.28	5		
30	3.80	78	3.85	70	2.60	31	3.55	59	1.25	4		
31	3.80	78			3.00	40			1.20	4		

NOTE.—Daily discharge determined from a series of parallel curves.

Monthly discharge of Harlem canal near Zurich, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 19–31	78	13	54.8	1,410
April	78	22	66.3	3,950
May	82	27	63.2	3,830
June	61	30	41.9	2,490
July	62	0	22.8	1,400
August 1–22	6	3	4.3	188
The year				13,300

NOTE.—Canal headgates opened Mar. 19 and closed on Aug. 22. No flow for periods Jan. 1 to Mar. 18 and Aug. 23 to Dec. 31.

AGENCY DITCH NEAR HARLEM, MONT.

Location.—At the highway bridge about one-fourth mile below the headgate of the ditch, reached by driving southward from Harlem, Mont.

Records available.—July 14, 1905, to July 31, 1911.

Gage.—Staff.

Discharge measurements.—Made by wading.

Discharge measurements of Agency ditch near Harlem, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 13	J. C. Beebe	3.59	76	June 27	J. C. Beebe	4.12	56
26	do	3.21	74	July 3	do	4.10	83
May 5	do		[a] 0.4	28	do	0.55	.8
June 22	do	3.98	49				

[a] Estimated.

Daily gage height, in feet, and discharge, in second-feet, of Agency ditch near Harlem, Mont., for 1911.

[J. E. Stevens, observer.]

Day.	April.		May.		June.		July.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1				0		0	4.20	77
2				0		0	4.20	81
3				0		0	4.08	82
4				0		0	4.00	79
5				0		0	3.75	71
6				0		0	3.70	71
7				0		0	3.90	77
8				0		0	3.90	77
9				0		0	3.90	77
10				0		0	3.85	78
11				0		0	3.64	71
12				0		0	3.60	70
13	3.59			0	3.85	67	3.52	67
14				0	4.08	74	3.80	78
15				0	4.09	70	3.50	68
16				0	3.95	66	3.40	65
17				0	3.80	61	3.30	62
18				0	3.80	57	3.46	69
19				0	3.90	60	2.70	45
20				0	4.00	60		
21				0	4.20	62		
22				0	4.20	62		
23				0	3.95	48		
24				0	3.90	46		
25				0	3.92	47		
26	3.21	74		0	3.94	50		
27	3.23	75		0	4.20	59		
28	3.24	75		0	4.40	70	0.55	
29	3.31	73		0	4.80	89		
30	3.43	77		0	4.50	82		
31				0				

NOTE.—Daily discharge determined by the indirect method for shifting channels.

Monthly discharge of Agency ditch near Harlem, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 26–31				238
April			75.0	4,460
May	0	0	.0	0
June	89	0	37.7	2,240
July	82		44.4	2,730

NOTE.—Discharge estimated, Apr. 1 to 25, as 75 second-feet, and as 1 second-foot per day July 20 to 31, on account of leakage through gates. Canal gates opened Mar. 26 and closed July 19.

FORT BELKNAP CANAL NEAR CHINOOK, MONT.

Location.—At the highway bridge about 500 feet below the head gates of the canal, 8 miles west of Chinook.

Records available.—June 21, 1903, to September 30, 1911.

Gages.—The high water of June, 1908, washed out both the bridge and the gage; a new gage was installed June 27, 1908, at a different datum within a few feet of the site of the old gage; a new bridge was built about one-fourth mile upstream from the site of the old one.

Discharge measurements.—Made by wading at a section about 300 feet below the gage.

Discharge measurements of Fort Belknap canal near Chinook, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 11	W. A. Lamb	2.14	50	June 20	J. C. Beebe	2.43	69
22	J. C. Beebe	2.96	104	26	do	2.20	55
May 1	do	3.00	110	29	do	1.56	26
8	do	2.86	97	July 8	do	1.87	33
12	do	2.71	94	27	do	2.23	48
22	do	2.16	51	Aug. 1	do	2.03	44
27	do	2.11	45	31	R. Richards	1.66	26
June 12	do	1.74	32				

Daily gage height, in feet, and discharge, in second-feet, of Fort Belknap canal near Chinook, Mont., for 1911.

[C. W. Hansen, observer.]

Day.	April.		May.		June.		July.		August.		September.	
	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
1	.....	.....	3.00	110	2.21	51	.....	28	2.00	43	1.15	16
2	.....	.....	3.00	110	2.21	51	.....	29	2.13	50	1.50	21
3	.....	.....	3.00	110	2.22	51	.....	30	2.15	50	1.30	17
4	.....	.....	3.00	110	2.22	51	.....	31	2.10	48	1.30	17
5	.....	.....	3.00	110	2.22	51	.....	32	2.02	44	0.40	8
6	.....	.....	2.70	86	2.00	43	.....	33	2.00	43	0.30	5
7	.....	.....	2.70	86	2.00	43	1.86	33	2.00	43	0.30	2
8	.....	.....	2.86	99	2.00	43	2.05	42	2.00	43	0.20	0
9	.....	.....	3.00	110	2.00	43	2.18	49	2.02	44	0.00	.....
10	.....	.....	3.00	110	.....	38	2.30	56	1.90	38	.....	.....
11	.....	.....	3.00	116	.....	34	2.28	55	2.00	43	.....	.....
12	.....	.....	2.71	95	1.70	30	2.28	55	1.70	30	.....	.....
13	.....	.....	2.70	94	1.70	30	2.23	52	1.80	34	.....	.....
14	.....	.....	2.70	94	1.70	30	2.18	49	1.80	34	.....	.....
15	.....	.....	2.70	94	1.60	27	2.26	54	1.78	30	.....	.....
16	.....	.....	3.00	116	1.60	27	2.38	61	1.77	30	.....	.....
17	.....	.....	3.00	116	2.00	43	2.46	66	1.50	21	.....	.....
18	.....	.....	3.00	110	2.00	43	2.40	58	1.80	31	.....	.....
19	.....	.....	2.70	86	2.40	65	2.41	59	1.65	26	.....	.....
20	.....	.....	2.70	86	2.40	65	2.38	57	1.70	27	.....	.....
21	2.97	158	2.80	94	2.50	72	2.40	58	1.70	27	.....	.....
22	2.97	158	2.16	51	2.50	72	2.36	56	1.78	30	.....	.....
23	2.97	158	2.56	76	2.60	79	2.30	52	1.84	33	.....	.....
24	2.80	94	2.56	76	2.62	80	2.34	54	1.90	35	.....	.....
25	2.70	86	2.66	80	2.62	80	2.34	54	1.87	34	.....	.....
26	2.60	79	2.66	80	2.00	43	2.28	51	1.88	34	.....	.....
27	2.80	94	2.11	45	2.10	48	2.24	48	1.90	35	.....	.....
28	2.70	86	2.11	45	1.70	30	2.22	47	1.70	27	.....	.....
29	2.60	79	2.11	45	1.70	30	2.18	45	1.20	16	.....	.....
30	2.80	94	2.11	45	1.60	27	2.10	48	1.21	16	.....	.....
31	.....	.....	2.21	51	.....	.....	2.04	45	1.15	16	.....	.....

Monthly discharge of Fort Belknap canal near Chinook, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 25–31	.....	.....	.....	[a] 450
April	.....	.....	[b] 109	[b] 4,250
May	116	45	88.3	5,430
June	80	27	47.3	2,810
July	66	28	48.0	2,950
August	50	16	34.0	2,090
September	21	0	2.9	171
The year	.....	.....	.....	18,200

[a] Estimated.
[b] Mean given is mean from Apr. 21 to 30. Flow, Apr. 1 to 20, estimated 2,090 acre-feet.

NOTE.—Canal opened Mar. 25 and closed Sept. 8. No flow Jan. 1 to Mar. 24 and Sept. 8 to Dec. 31.

LITTLE PORCUPINE CREEK BASIN.

LITTLE PORCUPINE CREEK NEAR FRAZER, MONT.

Location.—In S. E. ¼ N. E. ¼ sec. 28, T. 27 N., R. 44 E., above the intake of the reservoir, about 1½ miles above the site of the station maintained from 1908 to 1910 and about one-half mile north of Frazer.

Records available.—July 13, 1908, to September 30, 1910, at the original station; April 14, 1911, to October 31, 1911, at present site.

Drainage area.—Not measured.

Gage.—Staff; and about 2 miles farther upstream than that originally used.

Channel.—Shifting. On the date on which the station was reestablished in 1911 the channel was dry at the new gage but the stream was discharging 0.3 second-feet at the old gage, the water coming from springs near the gage. The channel was dry or water standing in pools until September 6.

Discharge measurements.—Made by wading.

Discharge measurements of Little Porcupine Creek near Frazer, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 19	John C. Beebe	2.97	0.73
May 16	do	2.80	[a] 0.1
Oct. 6	W. A. Lamb	3.98	40

[a] Estimated.

Daily gage height, in feet, and discharge, in second-feet, of Little Porcupine creek near Frazer, Mont., for 1911.

[Dan Martin, observer.]

Day.	September.		October.		Day.	September.		October.	
	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.
1	.....	0	3.25	7.0	16	5.2	122	3.45	14
2	.....	0	3.15	4.1	17	4.1	47	3.45	14
3	.....	0	3.20	5.4	18	3.8	30	3.40	12
4	.....	0	3.20	5.4	19	3.6	20	3.35	10
5	.....	0	3.40	12	20	3.30	8.5	3.25	7.0
6	3.35	10	3.90	35	21	3.30	8.5	3.30	8.5
7	5.1	115	3.60	20	22	3.30	8.5	3.30	8.5
8	6.1	195	3.50	16	23	3.30	8.5	3.30	8.5
9	5.3	129	3.45	14	24	3.30	8.5	3.30	8.5
10	4.3	59	3.40	12	25	3.30	8.5	3.30	8.5
11	4.4	66	3.45	14	26	3.30	8.5	3.30	8.5
12	3.8	30	3.65	22	27	3.30	8.5	3.30	8.5
13	3.30	8.5	3.45	14	28	3.30	8.5	3.30	8.5
14	3.30	8.5	3.40	12	29	3.30	8.5	3.30	8.5
15	3.30	8.5	3.60	20	30	3.30	8.5	3.30	8.5
					31	.....	.....	3.30	8.5

NOTE.—Daily discharge determined from a poorly defined rating curve.

Monthly discharge of Little Porcupine Creek near Frazer, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
September	195	0	31.4	1,870	C.
October	35	4.1	11.7	719	B.

WOLF CREEK BASIN.

WOLF CREEK NEAR WOLF POINT, MONT.

Location.—In the SE. ¼ SW. ¼ sec. 8, T. 27 N., R. 47 E., at William Smith's ranch, 2½ miles northwest of Wolf Point, Mont.

Records available.—August 15, 1908, to December 31, 1911.

Drainage area.—Not measured.

Gage.—A staff near the house of the observer.

Channel.—Shifting.

Discharge measurements.—Made by wading near the gage.

Diversions.—A small irrigation ditch diverts water above the gage.

Discharge measurements of Wolf Creek near Wolf Point, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 18	J. C. Beebe	2.04	8.2	May 17	J. C. Beebe	1.83	1.9
18	do	2.04	8.1	June 15	do	1.81	.6
May 17	do	1.83	1.8	Oct. 8	W. A. Lamb	2.20	7.2

Daily gage height, in feet, of Wolf Creek near Wolf Point, Mont., for 1911.

[W. H. Smith, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		2.05	2.05	2.25	2.45	1.4	1.45	2.25	2.25
2		2.05	2.05	2.2	2.4	1.45	1.45	2.25	2.2
3		2.0	2.0	2.25	2.25	1.4	3.5	2.2	2.25
4		2.05	2.05	2.2	2.2	1.45	3.55	2.05	2.2
5		2.0	2.0	2.25	2.25	1.45	3.5	2.0	2.25
6		2.05	2.05	2.25	2.25	1.2	3.55	2.05	2.25
7		2.05	1.85	2.2	2.2	1.25	3.55	2.05	2.2
8		2.0	1.8	2.25	2.25	1.2	3.5	2.2	2.25
9		2.05	1.85	2.2	2.2	1.25	3.55	2.25	2.2
10		2.0	1.8	2.25	2.25	1.25	3.8	2.2	2.25
11		2.05	1.85	1.85	2.05	1.2	3.85	2.25	2.25
12		2.05	1.85	1.8	2.0	1.25	3.85	2.25	
13		2.0	1.8	1.85	1.65	1.2	3.8	2.2	
14		2.05	1.85	1.8	1.6	1.25	3.85	2.25	
15		2.0	1.8	1.85	1.65	1.25	3.8	2.2	
16		2.05	1.85	1.85	1.65	1.2	3.85	2.25	
17		2.05	1.85	1.8	1.6	1.25	3.65	2.25	
18		2.0	1.8	1.85	1.65	1.2	3.6	2.2	
19	4.4	2.05	1.85	1.8	1.6	1.25	3.65	2.25	
20	4.45	2.0	1.8	1.85	1.65	1.45	2.2	2.2	
21	4.4	2.05	1.85	2.45	1.65	1.4	2.25	2.25	
22	4.45	2.05	1.85	2.4	1.6	1.45	2.25	2.25	
23	4.45	2.0	1.8	2.45	1.45	1.4	2.2	2.2	
24	4.2	2.05	2.25	2.4	1.4	1.45	2.25	2.25	
25	4.25	2.0	2.2	2.45	1.45	1.45	2.2	2.2	
26	4.0	2.05	2.25	2.45	1.45	1.4	2.25	2.25	
27	4.05	2.05	2.25	2.2	1.4	1.45	2.25	2.25	
28	3.05	2.0	2.2	2.25	1.45	1.4	2.2	2.2	
29	3.0	2.05	2.25	2.2	1.4	1.45	2.25	2.25	
30	3.05	2.0	2.2	2.25	1.45	1.45	2.2	2.2	
31	2.05		2.25		1.45	1.4		2.25	

Daily discharge, in second-feet, of Wolf Creek near Wolf Point, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	8.5	6.0	8.0	14	0.2	0.2	8.0	8.0
2	.....	8.5	6.0	7.0	12	.2	.2	8.0	7.0
3	.....	7.5	5.5	8.0	8.0	.2	79	7.0	8.0
4	.....	8.5	6.0	7.0	7.0	.2	83	4.2	7.0
5	.....	7.5	5.5	8.0	8.0	.2	79	3.5	8.0
6	.....	8.5	6.0	8.0	8.0	.0	83	4.2	8.0
7	.....	8.5	3.5	7.0	7.0	.0	83	4.2	7.0
8	.....	7.5	3.0	8.0	8.0	.0	79	7.0	8.0
9	.....	8.5	3.5	7.0	7.0	.0	83	8.0	7.0
10	.....	7.5	3.0	8.0	8.0	.0	103	7.0	8.0
11	.....	8.5	2.5	1.6	4.2	.0	107	8.0	8.0
12	.....	8.5	2.5	1.3	3.5	.0	107	8.0	.....
13	.....	7.5	2.0	1.6	.6	.0	103	7.0	.....
14	.....	8.5	2.5	1.3	.5	.0	107	8.0	.....
15	.....	7.5	2.0	1.6	.6	.0	103	7.0	.....
16	.....	8.5	2.5	1.6	.6	.0	107	8.0	.....
17	.....	8.5	2.5	1.3	.5	.0	93	8.0	.....
18	.....	7.5	1.3	1.6	.6	.0	87	7.0	.....
19	150	8.0	1.6	1.3	.5	.0	93	8.0	.....
20	154	7.0	1.3	1.6	.6	.2	7.0	7.0	.....
21	150	8.0	1.6	14	.6	.2	8.0	8.0	.....
22	154	8.0	1.6	12	.5	.2	8.0	8.0	.....
23	154	7.0	1.3	14	.2	.2	7.0	7.0	.....
24	134	7.0	8.0	12	.2	.2	8.0	8.0	.....
25	138	6.5	7.0	14	.2	.2	7.0	7.0	.....
26	119	7.0	8.0	14	.2	.2	8.0	8.0	.....
27	122	7.0	8.0	7.0	.2	.2	8.0	8.0	.....
28	52	6.5	7.0	8.0	.2	.2	7.0	7.0	.....
29	49	6.0	8.0	7.0	.2	.2	8.0	8.0	.....
30	52	5.5	7.0	8.0	.2	.2	7.0	7.0	.....
31	8.5	.....	8.0	.....	.2	.2	.....	8.0	.....

NOTE.—Daily discharge determined as follows: Mar. 19 to Apr. 18, from a curve poorly defined; Apr. 19 to May 17, by indirect method for shifting channels; May 18 to Nov. 11, from curve well defined.

Monthly discharge of Wolf Creek near Wolf Point, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	0.0	0.0	0.00	0	
February	.0	.0	.0	0	
March	154	.....	60.9	3,740	D.
April	8.5	5.5	7.65	455	C.
May	8.0	1.3	4.33	266	C.
June	14	1.3	6.66	396	B.
July	14	.2	3.29	202	B.
August	.2	.0	.11	6.8	B.
September	107	.2	55.4	3,300	B.
October	8.0	3.5	7.13	438	B.
November	.....	.....	5.97	355	
December	.....	.....	2.00	123	
The year	154	0	12.8	9,280	

NOTE.—Means for January, February, and December, estimated; mean for period Mar. 1 to 18, estimated at 25 second-feet; mean for period Nov. 12 to 30, estimated, at 5 second-feet.

POPLAR RIVER BASIN.

POPLAR RIVER NEAR POPLAR, MONT.

Location.—At the United States reclamation camp in the SW¼ SE. ¼ sec. 5, T. 21 N., R. 51 E., 12 miles upstream from the station formerly maintained at Buershia's ranch, 6 miles north of Poplar, Mont.

Records available.—August 15, 1908, to June 30, 1911, at old site; May 2, 1911, to September 30, 1911, at present site.

Drainage area.—Not measured.

Gage.—Staff on right bank; datum unchanged at the present station.

Channel.—Shifts.

Discharge measurements.—Made by wading.

Winter flow.—Ice present.

Discharge measurements of Poplar River near Poplar, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 16	J. C. Beebe	3.85	234	June 15	J. C. Beebe	2.95	65
16	do	4.01	284	30	do	2.57	21
May 15	do	2.66	31	30[a]	do	3.72	22
15	do	2.67	36	Oct. 9[a]	W. A. Lamb	4.55	147
June 15	do	2.95	64				

[a] Measurements at new station.

Daily gage height, in feet, and discharge, in second-feet, of Poplar River near Poplar, Mont., for 1911.

[Louis Obershaw, observer.]

Day.	April.		May.		June.		Day.	April.		May.		June.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			3.35	136	3.15	99	16			2.85	52	2.95	66
2			3.35	136	3.25	117	17			2.75	40		62
3			3.25	117	4.15	308	18			2.85	52		58
4			3.25	117	4.35	358	19			2.85	52		54
5			3.25	117	3.45	155	20			2.85	52		52
6			3.15	99	3.35	136	21			2.75	40		48
7			3.05	82	3.35	136	22			2.65	30		46
8			2.85	52	3.35	136	23	3.75	215	2.55	22		44
9			2.85	52	3.25	117	24	3.85	235	2.55	22		42
10			2.85	52	3.25	117	25	3.65	195	2.55	22	2.75	40
11			2.75	40	3.25	117	26	3.65	195	2.55	22	2.75	40
12			2.75	40	3.15	99	27	3.55	175	2.85	52	2.65	30
13			2.75	40	3.05	82	28	3.45	155	3.15	99	2.65	30
14			2.85	52	3.05	82	29	3.45	155	3.15	99	2.65	30
15			2.75	40	2.95	66	30	3.35	136	3.15	99	2.65	30
							31			3.15	99		

NOTE.—Daily discharge determined from a well-defined rating curve. Discharge interpolated June 17 to 24.

Monthly discharge of Poplar River near Poplar, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 23-30	235	136	183	2,900
May	136	22	65.7	4,040
June	358	30	93.2	5,550

Daily gage height, in feet, and discharge, in second-feet, of Poplar River at United States Reclamation Service camp near Poplar, Mont., for 1911.

[B. M. Conner, observer.]

Day.	May.		June.		July.		August.		September.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	126	4.30	99	4.00	52	3.70	21	3.70	21
2	4.45	126	4.40	117	4.00	52	3.70	21	3.65	17
3	4.35	108	4.9	215	4.50	136	3.90	40	3.65	17
4	4.35	108	4.6	155	4.30	99	3.90	40	3.65	17
5	4.25	90	4.6	155	4.20	82	4.00	52	3.90	40
6	4.25	90	4.6	155	4.05	59	4.00	52	5.6	390
7	4.20	82	4.5	136	4.00	52	3.95	46	5.9	465
8	4.15	74	4.45	126	4.00	52	3.90	40	5.6	390
9	4.10	66	4.45	126	3.90	40	4.30	99	.....	365
10	4.10	66	4.40	117	3.90	40	4.10	66	.....	340
11	4.05	59	4.30	99	3.85	35	4.05	59	.....	315
12	4.00	52	4.30	99	3.85	35	4.00	52	.....	290
13	4.00	52	4.25	90	3.85	35	3.95	46	.....	265
14	3.95	46	4.20	82	3.85	35	3.90	40	.....	240
15	3.95	46	4.15	74	3.80	30	3.90	40	.....	215
16	4.00	52	4.10	66	3.80	30	3.85	35	.....	190
17	4.00	52	4.10	66	3.80	30	3.80	30	4.6	155
18	3.95	46	4.05	59	3.75	26	3.80	30	4.6	155
19	3.95	46	4.05	59	3.70	21	3.80	30	4.6	155
20	3.90	40	4.00	52	3.70	21	3.80	30	.....	147
21	3.90	40	3.95	46	3.70	21	3.80	30	.....	139
22	3.90	40	4.05	59	3.70	21	3.80	30	.....	131
23	3.90	40	3.95	46	3.80	30	.....	30	.....	123
24	3.90	40	3.90	40	3.80	30	.....	29	.....	115
25	3.90	40	3.90	40	3.75	26	.....	28	.....	107
26	4.10	66	3.90	40	3.70	21	.....	28	.....	99
27	4.30	99	3.90	40	3.75	26	.....	27	.....	91
28	4.25	90	3.85	35	3.75	26	.....	27	4.20	82
29	4.25	90	3.85	35	3.75	26	3.75	26	4.15	74
30	4.30	99	3.90	40	3.75	26	3.70	21	4.10	66
31	4.30	99	.....	.....	3.70	21	3.70	21	.....	.....

NOTE.—Daily discharge determined from curve based on two measurements and slope data. Discharge interpolated for days for which gage heights are missing.

Monthly discharge of Poplar River at United States Reclamation Service camp near Poplar, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	126	40	70.0	4,300	C.
June	215	35	85.6	5,090	C.
July	136	21	39.9	2,450	C.
August	99	21	37.6	2,310	C.
September	465	17	174	10,400	C.

BIG MUDDY CREEK NEAR CULBERTSON, MONT.

Location.—In the SW. ¼ sec. 17, T. 29 N., R. 54 E., at Gustave Sholtz's ranch, 11 miles above the mouth of the stream and 8 miles above the site of the original station, which was discontinued because gage heights were affected by backwater from the Missouri.

Records available.—July 14, 1908, to July 19, 1909, at original station; July 19, 1909, to December 31, 1911, at present station.

Gage.—An inclined rod on left bank of stream near residence of observer; datum unchanged.

Channel.—Mud.

Discharge measurements.—Made by wading.

Winter flow.—Little if any flow during months of January, February, October, November, and December.

Accuracy.—Results at new station are good.

Discharge measurements of Big Muddy Creek near Culbertson, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 17	J. C. Beebe	4.74	162	June 14	J. C. Beebe	3.65	33
17	do	4.77	160	July 27	do	2.89	5.6
May 14	do	2.40	15.7	Oct. 5	W. A. Lamb	2.65	12

Daily gage height, in feet, of Big Muddy Creek near Culbertson, Mont., for 1911.

[Thos. Shields, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		3.45	2.5	2.8	3.75	2.95	3.65	2.5	2.4
2		3.45	2.4	2.8	3.65	2.95	3.55	2.5	2.4
3		4.35	2.4	2.9	3.65	3.15	3.6	2.5	2.4
4		4.7	2.4	2.9	3.65	3.25	3.65	2.6	2.3
5		5.3	2.4	2.9	3.45	3.25	3.65	2.7	2.3
6		5.3	2.4	2.9	3.45	3.45	3.7	2.95	2.3
7		5.8	2.5	3.35	3.45	3.35	3.65	3.05	2.3
8		4.8	2.5	3.35	3.35	3.35	3.65	3.35	
9		4.8	2.5	3.45	3.35	3.35	3.55	3.75	
10		4.7	2.5	3.55	3.25	3.35	3.25	4.45	
11		4.6	2.5	3.55	3.25	3.35	3.25	4.55	
12		4.3	2.5	3.65	3.25	3.3	3.15	4.25	
13		4.3	2.5	3.65	3.25	3.25	3.15	3.95	
14		4.5	2.3	3.65	3.25	3.25	3.95	3.45	
15		4.5	2.3	3.65	3.25	3.25	4.35	3.15	
16		4.7	2.3	3.55		3.25	4.45	3.05	
17		4.7	2.3	3.55		3.15	4.25	2.95	
18		4.9	2.3	3.45		3.15	3.95	2.85	
19		4.9	2.3	3.35		3.15	3.75	2.8	
20		4.9	2.3	3.35		3.15	3.55	2.7	
21		4.5	2.3	3.35		3.15	3.35	2.7	
22		4.15	2.3	3.45		3.05	3.15	2.6	
23		2.9	2.3	3.75		2.95	3.05	2.6	
24		2.8	2.3	3.75		2.85	2.95	2.5	
25		2.8	2.4	3.75		3.0	2.85	2.4	
26		2.7	2.5	3.75		2.95	2.8	2.4	
27	3.35	2.6	2.5	3.75	2.89	3.85	2.8	2.4	
28	3.35	2.6	2.5	3.75		3.85	2.7	2.4	
29	3.35	2.6	2.5	3.75		3.75	2.7	2.4	
30	3.35	2.5	2.6	3.75	2.85	3.75		2.4	
31	3.45		2.8		2.9	3.65		2.4	

Daily discharge, in second-feet, of Big Muddy Creek near Culbertson, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	33	8	12	39	6	58	8	6
2	.....	33	8	12	33	6	48	8	6
3	.....	112	8	12	33	12	52	8	6
4	.....	151	8	12	33	18	58	11	4
5	.....	220	8	12	22	18	58	14	4
6	.....	220	8	12	22	28	70	24	4
7	.....	280	14	23	22	24	58	28	4
8	.....	162	14	23	18	24	58	48	.....
9	.....	162	14	29	18	24	48	83	.....
10	.....	151	14	34	14	24	28	160	.....
11	.....	140	14	27	14	24	28	172	.....
12	.....	107	18	33	14	21	23	136	.....
13	.....	107	18	33	14	18	23	103	.....
14	.....	129	14	33	14	18	102	56	.....
15	.....	129	12	33	14	18	132	34	.....
16	.....	151	12	27	14	18	144	28	.....
17	.....	151	12	27	13	15	121	24	.....
18	.....	173	9	22	13	19	90	19	.....
19	.....	173	9	18	15	19	82	17	.....
20	.....	173	9	18	13	19	55	14	.....
21	.....	129	9	18	10	19	40	14	.....
22	.....	106	7	22	8	15	28	11	.....
23	.....	14	7	39	6	12	24	11	.....
24	.....	12	7	39	6	9	18	8	.....
25	.....	12	9	39	5	14	16	6	.....
26	.....	10	8	39	5	12	14	6	.....
27	27	10	8	39	5	64	14	6	.....
28	27	10	8	39	5	64	11	6	.....
29	27	10	8	39	4.5	56	14	6	.....
30	27	8	8	39	4.5	56	11	6	.....
31	33	.....	12	.....	5	48	.....	6	.....

NOTE.—Daily discharge determined from a series of parallel curves and by the indirect method for shifting channels. Discharge interpolated for days for which gage heights are missing.

Monthly discharge of Big Muddy Creek near Culbertson, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	0	0	
February	.....	.....	0	0	
March	.....	.....	25.5	1,570	D.
April	280	8	109	6,490	C.
May	18	7	10.4	640	C.
June	39	12	26.8	1,590	C.
July	39	4.5	14.7	904	C.
August	64	6	23.9	1,470	C.
September	144	11	50.9	3,030	C.
October	172	6	34.9	2,150	C.
November	.....	.....	3.4	202	D.
December	.....	.....	0	0	
The year	280	0	24.9	18,000	

NOTE.—Discharge Mar. 1 to 26 estimated at 25 second-feet per day, and Nov. 8 to 30 at 3 second-feet.

YELLOWSTONE RIVER BASIN.

YELLOWSTONE RIVER AT CORWIN SPRINGS, MONT.

Location.—In the NE. ¼ sec. 30, T. 8 S., R. 8 E., in the canyon at Corwin Springs, Mont., 8 miles below Gardiner, the northern entrance to Yellowstone National Park.

Records available.—September 2, 1910, to December 31, 1911.

Drainage area.—2,630 square miles.

Gage.—Staff gage nailed to wooden pier (right bank) on lower side of highway bridge.

Channel.—Bed of stream rocky; free from vegetation.

Discharge measurements.—Made from the lower side of highway bridge.

Diversions.—No water is diverted from the Yellowstone above this station.

Discharge measurements of Yellowstone River at Corwin Springs, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
July 10	R. Richards	6.31	10,200
Aug. 17	B. E. Jones	3.40	3,450
Oct. 25	do	1.69	1,480
26	do	1.56	1,400

Daily gage height, in feet, and discharge, in second-feet, of Yellowstone River at Corwin Springs, Mont., for 1910.

[C. H. Wilks, jr., observer.]

Day.	September.		October.		November.		December.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1		1,600	1.4	1,300	1.2	1,160	1.1	1,100
2	1.8	1,620	1.4	1,300	1.2	1,160	1.1	1,100
3	1.7	1,530	1.4	1,300	1.2	1,160	1.1	1,100
4	1.7	1,530	1.5	1,370	1.2	1,160	1.1	1,100
5	1.7	1,530	1.5	1,370	1.1	1,100	1.0	1,040
6	1.7	1,530	1.5	1,370	1.1	1,100	1.1	1,100
7	1.7	1,530	1.4	1,300	1.1	1,100	1.0	1,040
8	1.7	1,530	1.4	1,300	1.1	1,100	1.0	1,040
9	1.6	1,450	1.4	1,300	1.2	1,160	1.0	1,040
10	1.5	1,370	1.4	1,300	1.2	1,160	1.0	1,040
11	1.6	1,450	1.4	1,300	1.2	1,160	1.0	1,040
12	1.6	1,450	1.4	1,300	1.1	1,100	1.0	1,040
13	1.6	1,450	1.5	1,370	1.2	1,160		
14	1.6	1,450	1.4	1,300	1.1	1,100		
15	1.6	1,450	1.4	1,300	1.0	1,040		
16	1.6	1,450	1.4	1,300	1.0	1,040		
17	1.6	1,450	1.4	1,300	1.1	1,100		
18	1.6	1,450	1.4	1,300	1.1	1,100		
19	1.5	1,370	1.4	1,300	1.1	1,100		
20	1.5	1,370	1.3	1,230	1.0	1,040		
21	1.5	1,370	1.3	1,230	1.1	1,100		
22	1.6	1,450	1.3	1,230	1.1	1,100		
23	1.6	1,450	1.3	1,230	1.1	1,100		
24	1.5	1,370	1.3	1,230	1.1	1,100		
25	1.5	1,370	1.3	1,230	1.1	1,100		
26	1.5	1,370	1.3	1,230	1.2	1,160		
27	1.5	1,370	1.2	1,160	1.0	1,040		
28	1.5	1,370	1.2	1,160	1.0	1,040		
29	1.5	1,370	1.2	1,160	1.1	1,100		
30	1.4	1,300	1.2	1,160	1.1	1,100		
31			1.2	1,160				

Daily gage height, in feet, of Yellowstone River at Corwin Springs, Mont., for 1911.

[C. H. Wilks, jr., observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.4	1.9	6.6	7.8	4.5	2.6	2.0	1.4	1.6
2	.....	1.5	1.9	7.2	7.4	4.5	2.6	2.1	1.4	1.3
3	.....	1.5	2.0	6.7	7.4	4.4	2.6	2.2	1.4	1.3
4	.....	1.5	2.2	7.0	7.5	4.3	2.6	2.1	1.5	1.3
5	.....	1.4	2.6	7.4	7.2	4.3	2.6	2.0	1.5	1.3
6	.....	1.5	3.8	7.6	7.2	4.2	2.7	2.0	1.5	1.3
7	.....	1.6	3.3	7.6	7.2	4.2	2.7	2.0	1.4	1.3
8	0.8	1.4	3.5	8.2	7.2	4.1	2.7	2.0	1.4	1.3
9	.8	1.4	4.2	8.4	7.0	4.0	2.7	1.9	1.4	1.3
10	.8	1.4	3.7	8.0	6.3	3.9	2.6	1.9	1.4	1.3
11	.8	1.4	3.3	8.4	6.2	3.8	2.5	1.9	1.3	1.3
12	.8	1.4	3.2	9.2	6.0	3.8	2.4	1.9	1.2	1.3
13	.8	1.3	3.9	10.2	6.1	3.7	2.4	1.9	1.4	1.2
14	.8	1.2	4.1	9.8	6.0	3.6	2.4	1.9	1.5	1.2
15	.8	1.2	4.7	9.4	5.9	3.5	2.4	2.0	1.6	1.3
16	.9	1.3	4.9	9.4	5.7	3.5	2.4	1.9	1.6	1.3
17	.9	1.4	4.2	9.0	5.6	3.4	2.3	1.9	1.5	1.2
18	1.0	1.4	4.0	9.0	5.6	3.4	2.2	1.8	1.5	1.2
19	1.0	1.5	3.7	9.2	5.4	3.3	2.2	1.8	1.5	1.1
20	1.1	1.5	3.4	9.2	5.4	3.2	2.2	1.7	1.6	1.3
21	1.2	1.6	3.3	9.4	5.3	3.2	2.1	1.7	1.5	1.2
22	1.2	1.7	3.7	9.7	5.2	3.1	2.1	1.7	1.5	1.2
23	1.2	1.6	3.9	9.4	5.1	3.0	2.1	1.7	1.4	1.3
24	1.3	1.6	4.6	9.0	4.9	3.0	2.1	1.7	1.4	1.2
25	1.3	1.6	5.0	8.2	4.8	3.0	2.2	1.7	1.4	1.2
26	1.2	1.7	5.6	7.9	4.7	3.0	2.2	1.6	1.5	1.4
27	1.2	1.9	4.7	7.8	4.9	2.9	2.1	1.6	1.5	1.2
28	1.2	2.0	4.3	8.2	4.8	2.8	2.1	1.6	1.3	1.2
29	1.2	2.0	4.1	7.8	4.7	2.8	2.1	1.5	1.4	.....
30	1.3	1.9	4.5	7.8	4.6	2.8	2.0	1.5	1.4	1.4
31	1.4	.....	5.4	.....	4.7	2.7	.....	1.5	.....	1.6

Daily discharge, in second-feet, of Yellowstone River at Corwin Springs, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1,300	1,710	11,100	14,800	5,520	2,410	1,800	1,300	1,450
2	.....	1,370	1,710	12,900	13,500	5,520	2,410	1,890	1,300	1,230
3	.....	1,370	1,800	11,400	13,500	5,300	2,410	1,990	1,300	1,230
4	.....	1,370	1,990	12,300	13,800	5,090	2,410	1,890	1,370	1,230
5	.....	1,300	2,410	13,500	12,900	5,090	2,410	1,800	1,370	1,230
6	.....	1,370	4,130	14,200	12,900	4,890	2,530	1,800	1,370	1,230
7	.....	1,450	3,320	14,200	12,900	4,890	2,530	1,800	1,300	1,230
8	950	1,300	3,630	16,100	12,900	4,690	2,530	1,800	1,300	1,230
9	950	1,300	4,890	16,700	12,300	4,500	2,530	1,710	1,300	1,230
10	950	1,300	3,960	15,400	10,200	4,310	2,410	1,710	1,300	1,230
11	950	1,300	3,320	16,700	9,870	4,130	2,300	1,710	1,230	1,230
12	950	1,300	3,170	19,400	9,300	4,130	2,190	1,710	1,160	1,230
13	950	1,230	4,310	22,800	9,580	3,960	2,190	1,710	1,300	1,160
14	950	1,160	4,690	21,400	9,300	3,790	2,190	1,710	1,370	1,160
15	950	1,160	5,970	20,100	9,030	3,630	2,190	1,800	1,450	1,230
16	990	1,230	6,450	20,100	8,490	3,630	2,190	1,710	1,450	1,230
17	990	1,300	4,890	18,700	8,230	3,470	2,090	1,710	1,370	1,160
18	1,040	1,300	4,500	18,700	8,230	3,470	1,990	1,620	1,370	1,160
19	1,040	1,370	3,960	19,400	7,710	3,320	1,990	1,620	1,370	1,100
20	1,100	1,370	3,470	19,400	7,710	3,170	1,990	1,530	1,450	1,230
21	1,160	1,450	3,320	20,100	7,450	3,170	1,890	1,530	1,370	1,160
22	1,160	1,530	3,960	21,100	7,200	3,030	1,890	1,530	1,370	1,160
23	1,160	1,450	4,310	20,100	6,950	2,900	1,890	1,530	1,300	1,230
24	1,230	1,450	5,740	18,700	6,450	2,900	1,890	1,530	1,300	1,160
25	1,230	1,450	6,700	16,100	6,210	2,900	1,990	1,530	1,300	1,160
26	1,160	1,530	8,230	15,100	5,970	2,900	1,990	1,450	1,370	1,300
27	1,160	1,710	5,970	14,800	6,450	2,770	1,890	1,450	1,370	1,160
28	1,160	1,800	5,090	16,100	6,210	2,650	1,890	1,450	1,230	1,160
29	1,160	1,800	4,690	14,800	5,970	2,650	1,890	1,370	1,300	1,100
30	1,230	1,710	5,520	14,800	5,740	2,650	1,800	1,370	1,300	1,100
31	1,300	.....	7,710	.....	5,970	2,530	.....	1,370	.....	1,100

NOTE.—Daily discharge determined from a rating curve that is fairly well defined below 12,300 second-feet.

Monthly discharge of Yellowstone River at Corwin Springs, Mont., for 1910–11.

[Drainage area, 2,630 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1910.							
September	1,620	1,300	1,440	0.548	0.61	85,700	B.
October	1,370	1,160	1,270	.483	.56	78,100	B.
November	1,160	1,040	1,110	.422	.47	66,100	B.
December	1,100	.....	995	.378	.44	61,200	C.
1911.							
January	.....	.....	[a] 900	.342	.39	55,300	
February	.....	.....	[a] 900	.342	.36	50,000	
March	1,300	950	1,050	.399	.46	64,600	B.
April	1,800	1,160	1,400	.532	.59	83,300	B.
May	8,230	1,710	4,370	1.66	1.91	269,000	B.
June	22,800	11,100	16,900	6.43	7.17	1,010,000	C.
July	14,800	5,740	9,280	3.53	4.07	571,000	B.
August	5,520	2,530	3,790	1.44	1.66	233,000	B.
September	2,530	1,800	2,160	.821	.92	129,000	B.
October	1,990	1,370	1,650	.627	.72	101,000	B.
November	1,450	1,160	1,330	.506	.56	79,100	B.
December	1,450	1,100	1,200	.456	.53	73,800	B.
The year	.....	.....	3,740	1.42	19.34	2,720,000	

[a] Estimated.

NOTE.—Means for periods Dec. 13 to 31, 1910, and March 1 to 7, 1911, estimated at 950 second-feet.

YELLOWSTONE RIVER AT HUNTLEY, MONT.

Location.—In the SW. ¼ sec. 24, T. 2 N., R. 27 E., at the new steel highway bridge 1 mile below Huntley, Mont., 1 mile below Pryor Creek. Station replaces that formerly maintained at Junction.

Records available.—October 1, 1907, to December 31, 1911.

Drainage area.—12,000 square miles.

Gage.—Chain fastened to bridge rail; datum unchanged.

Channel.—Shifts.

Discharge measurements.—Made from downstream side of bridge.

Winter flow.—River frozen entirely over in places during the winter, but during the coldest seasons open channels with floating ice are not of uncommon occurrence.

Diversions.—The Huntley canal, built by the United States Reclamation Service, takes water from the river about 2 miles above the gaging station; its normal capacity is 400 second-feet, and it supplies the water for 29,000 acres of land. Near Laurel are the headgates of the Billings Land & Irrigation Co.'s canal, which carries about 305 second-feet and irrigates 28,000 acres. Many small ditches take water from the tributaries of the Yellowstone, but few from the stream itself, owing to the variation of the stage of the water surface and consequent difficulty of diversion.

Accuracy.—Conditions for obtaining accurate data at this station are only fair and many discharge measurements are necessary to define a good rating curve.

Discharge measurements of Yellowstone River at Huntley, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 17	W. A. Lamb	5.40	15,800	Aug. 10	B. E. Jones	4.14	9,940
June 15[a]	R. Richards	10.92	47,200	Sept. 11	R. Richards	2.63	5,040
July 25	B. E. Jones	4.62	12,100				

[a] Surface velocities reduced by 0.90.

Daily gage height, in feet, of Yellowstone River at Huntley, Mont., for 1911.

[Arthur Foster, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.3	4.2	3.8	2.6	2.8	5.9	7.0	4.4	2.5	2.5	2.15	2.05
2	2.3	4.2	3.8	2.6	2.8	8.2	7.0	4.4	2.5	2.45	2.15	2.0
3	2.4	4.2	3.8	2.6	2.7	9.2	6.9	4.4	2.5	2.4	2.15	2.0
4	2.4	4.2	3.8	2.6	2.8	9.0	6.6	4.3	2.5	2.4	2.15	1.95
5	2.5	4.2	3.8	2.6	2.7	8.8	6.8	4.3	2.4	2.35	2.2	1.9
6	3.3	4.0	3.9	2.6	2.7	9.2	6.8	4.3	2.4	2.35	2.2	1.9
7	3.0	4.0	4.2	2.6	3.6	8.9	6.9	.....	2.5	2.3	2.4	1.9
8	3.0	4.0	4.7	2.6	4.0	9.0	7.0	.....	2.6	2.3	2.5	1.9
9	2.8	4.0	4.8	2.5	4.0	9.6	6.5	.....	2.6	2.3	3.2	1.9
10	2.7	4.0	5.0	2.4	4.0	9.2	6.4	.....	2.6	2.25	3.4	1.9
11	2.7	4.0	4.4	2.4	4.4	9.8	6.0	.....	2.6	2.25	3.6	1.9
12	2.7	4.2	4.1	2.4	4.0	10.6	5.8	.....	2.6	2.20	3.7	1.7
13	2.7	4.3	3.8	2.4	3.9	10.8	5.7	.....	2.6	2.20	3.7	1.7
14	2.7	4.0	3.6	2.4	3.8	11.0	5.4	.....	2.5	2.20	4.1	1.65
15	2.7	4.0	3.8	2.3	4.4	11.0	5.4	3.5	2.4	2.30	4.5	1.6
16	2.7	3.9	3.6	2.3	5.0	10.6	5.3	3.5	2.4	2.30	4.7	1.6
17	3.0	3.9	3.4	2.4	5.5	10.1	5.2	3.8	.....	2.30	5.5	1.6
18	3.1	3.8	3.0	2.3	5.1	9.80	5.2	3.6	.....	2.25	5.3	1.6
19	4.2	3.7	2.8	2.4	4.6	9.7	5.3	3.6	.....	2.25	5.2	1.6
20	4.0	3.7	2.6	2.4	4.2	10.0	5.2	3.0	.....	2.25	4.8	1.6
21	3.1	3.6	2.6	2.4	4.2	10.2	5.1	3.0	.....	2.2	4.5	1.6
22	3.5	3.5	2.6	2.4	4.1	9.6	5.1	3.0	.....	2.2	4.1	1.6
23	3.5	3.5	2.5	3.1	4.0	9.1	5.0	2.9	.....	2.2	3.0	1.6
24	3.7	3.6	2.5	3.0	3.8	8.8	5.0	2.9	.....	2.2	2.45	1.6
25	4.2	3.8	2.4	2.8	4.4	8.1	4.7	2.8	.....	2.25	2.4	1.6
26	4.2	3.8	2.4	2.6	5.8	7.9	4.4	2.8	.....	2.3	2.3	1.6
27	4.2	3.8	2.5	2.7	6.3	7.6	4.4	2.8	.....	2.2	2.1	1.6
28	4.2	3.8	2.4	3.10	5.8	7.4	4.4	2.7	.....	2.15	2.1	1.9
29	4.2	.....	2.5	3.10	5.3	7.1	4.4	2.7	.....	2.15	2.1	1.95
30	4.2	.....	2.6	3.0	5.1	7.0	4.4	2.7	.....	2.1	2.05	2.0
31	4.2	.....	2.6	.....	5.1	.....	4.4	2.6	.....	2.1	.....	2.0

NOTE.—Gage heights distorted by ice Jan. 1 to Mar. 13 and Nov. 7 to Dec. 31.

Daily discharge, in second-feet, of Yellowstone River at Huntley, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	2,500	4,900	5,500	18,300	24,200	11,000	4,600	4,600	3,640
2	3,000	4,900	5,500	31,200	24,200	11,000	4,600	4,460	3,640
3	3,000	4,900	5,200	37,000	23,700	11,000	4,600	4,320	3,640
4	4,000	4,900	5,500	35,800	22,000	10,600	4,600	4,320	3,640
5	4,000	4,900	5,200	34,600	23,100	10,600	4,320	4,190	3,780
6	5,000	4,900	5,200	37,000	23,100	10,600	4,320	4,190	3,780
7	5,000	4,900	8,000	35,200	23,700	10,000	4,600	4,050	.....
8	6,000	4,900	9,400	35,800	24,200	10,000	4,900	4,050	.....
9	6,000	4,600	9,400	39,300	21,500	9,000	4,900	4,050	.....
10	6,000	4,320	9,400	37,000	21,000	9,000	4,900	3,910	.....
11	7,000	4,320	11,000	40,500	18,800	9,000	4,900	3,910	.....
12	7,000	4,320	9,400	45,400	17,800	8,000	4,900	3,780	.....
13	7,000	4,320	9,050	46,700	17,300	8,000	4,900	3,780	.....
14	8,000	4,320	8,700	47,900	15,800	8,000	4,600	3,780	.....
15	8,700	4,050	11,000	47,900	15,800	7,650	4,320	4,050	.....
16	8,000	4,050	13,800	45,400	15,300	7,650	4,320	4,050	.....
17	7,320	4,320	16,300	42,300	14,800	8,700	4,340	4,050	.....
18	6,100	4,050	14,300	40,500	14,800	8,000	4,360	3,910	.....
19	5,500	4,320	11,900	39,900	15,300	8,000	4,380	3,910	.....
20	4,900	4,320	10,200	41,700	14,800	6,100	4,400	3,910	.....
21	4,900	4,320	10,200	42,900	14,300	6,100	4,420	3,780	.....
22	4,900	4,320	9,800	39,300	14,300	6,100	4,440	3,780	.....
23	4,600	6,400	9,400	36,400	13,800	5,800	4,460	3,780	.....
24	4,600	6,100	8,700	34,600	13,800	5,800	4,480	3,780	.....
25	4,320	5,500	11,000	30,600	12,400	5,500	4,500	3,910	.....
26	4,320	4,900	17,800	29,400	11,000	5,500	4,520	4,050	.....
27	4,600	5,200	20,400	27,700	11,000	5,500	4,540	3,780	.....
28	4,320	6,400	17,800	26,500	11,000	5,200	4,560	3,640	.....
29	4,600	6,400	15,300	24,800	11,000	5,200	4,580	3,640	.....
30	4,900	6,100	14,300	24,200	11,000	5,200	4,600	3,500	.....
31	4,900	.....	14,300	.....	11,000	4,900	.....	3,500	.....

NOTE.—Daily discharge determined from a rating curve fairly well defined between 2,000 and 48,000 second-feet. Discharge estimated Mar. 1 to 13, Aug. 7 to 14, and Sept. 17 to 30.

Monthly discharge of Yellowstone River at Huntley, Mont., for 1911.

[Drainage area, 12,000 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	*a* 2,000	0.167	0.19	123,000	
February	.....	.....	*a* 2,200	.183	.19	122,000	
March	8,700	2,500	5,320	.443	.51	327,000	C.
April	6,400	4,050	4,870	.406	.45	290,000	B.
May	20,400	5,200	10,700	.892	1.03	658,000	B.
June	47,900	18,300	36,500	3.04	3.39	2,170,000	B.
July	24,200	11,000	17,000	1.42	1.64	1,050,000	B.
August	11,000	4,900	7,830	.652	.75	481,000	B.
September	4,900	4,320	4,560	.380	.42	271,000	B.
October	4,600	3,500	3,950	.329	.38	243,000	B.
November	3,780	.....	3,140	.262	.29	187,000	C.
December	.....	.....	*a* 2,300	.192	.22	141,000	
The year	47,900	.....	8,370	.698	9.46	6,060,000	

a Estimated.

NOTE.—Mean discharge Nov. 7 to 30 estimated at 3,000 second-feet.

YELLOWSTONE RIVER AT LOWER YELLOWSTONE DAM, AT INTAKE, MONT.

Location.—At the Lower Yellowstone diversion dam, at Intake and 18 miles below Glendive, Mont.

Records available.—Records by War Department and Department of Agriculture, 1893 to 1903; August 1, 1903, to December 31, 1911, by United States Geological Survey. Records January 1 to December 31, 1911, from observations at the present station, which replaces the one formerly maintained at Glendive.

Gage.—A chain gage on the north abutment of the dam. The gage readings show the depth of water on the crest of the dam.

Winter flow.—Affected by ice.

The dam.—The dam, a rock-filled timber-crib structure on a pile foundation, was completed January 29, 1910. It is 700 feet long, crosses the stream at right angles to the current, and will raise the low-water level of the river about 4 feet. The dam is specially designed to resist the destructive effects of ice by having an approach on a slope of 3 to 1, and the downstream face is ogee-shaped and protected by a heavy rock apron.

Diversions.—The Lower Yellowstone canal, which diverts water to irrigate 66,000 acres of land, has its headworks at the north abutment.

Accuracy.—A curve showing relation of gage heights at Glendive and at Lower Yellowstone dam was constructed. Using this curve of relation and discharge measurements made at Glendive, a discharge curve was constructed which is applicable to the gage heights of Lower Yellowstone dam, and should give fair results.

Daily gage height, in feet, of Yellowstone River over Lower Yellowstone dam, at Intake, Mont., for 1911.

[T. F. Hansford, observer.]

Day.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	.....	.....	1.8	4.6	5.6	3.4	2.3	1.8	1.6
2	.....	.....	1.7	1.85	4.7	5.6	3.3	2.25	1.8	1.6
3	.....	.....	1.7	1.85	5.0	5.4	3.5	2.2	1.9	1.6
4	.....	.....	1.7	1.85	5.5	5.3	3.5	2.15	1.9	1.5
5	0.5	.....	1.7	1.9	5.6	5.2	3.5	2.15	1.9	1.55
6	.....	.....	1.7	1.85	5.6	5.0	3.4	2.6	2.0	1.55
7	.....	.....	1.7	1.85	5.5	4.9	3.4	3.3	1.9	1.55
8	.....	2.8	1.65	1.85	5.7	5.0	3.9	4.1	1.9	.....
9	1.0	3.0	1.65	1.9	5.8	4.9	4.1	3.7	1.9	.....
10	.....	3.4	1.65	2.0	6.6	4.9	4.0	3.0	1.9	.....
11	.....	7.6	1.65	2.2	6.8	4.9	3.9	2.8	1.9	.....
12	1.3	8.6	1.6	2.4	6.5	4.8	3.5	2.5	1.85	.....
13	.....	11.6	1.6	2.6	6.3	4.5	3.4	2.3	1.8	.....
14	.....	4.2	1.6	2.6	6.1	4.2	3.3	2.3	1.8	.....
15	.....	3.3	1.6	2.7	6.5	4.1	3.1	2.2	1.8	.....
16	1.5	2.9	1.6	2.8	7.1	4.1	3.0	2.15	1.75	.....
17	.....	2.8	1.6	2.95	7.4	3.9	2.95	2.1	1.75	.....
18	1.1	2.6	1.55	3.1	7.7	3.9	2.9	2.0	1.7	.....
19	.....	2.6	1.5	3.4	7.7	3.8	2.8	2.0	1.7	.....
20	.....	2.6	1.5	3.8	7.5	3.8	3.0	2.0	1.75	.....
21	1.4	2.6	1.45	3.5	7.4	3.8	3.0	2.0	1.75	.....
22	.....	2.5	1.45	3.2	8.0	4.0	2.8	2.0	1.75	.....
23	.....	2.4	1.5	3.1	7.9	4.0	2.7	2.0	1.7	.....
24	.....	2.2	1.5	3.0	7.7	3.8	2.6	1.9	1.7	.....
25	1.7	2.0	1.55	2.8	7.55	3.8	2.5	1.9	1.7	.....
26	.....	2.0	1.6	3.2	7.3	3.8	2.5	1.85	1.7	.....
27	.....	1.9	1.75	3.3	6.9	3.6	2.4	1.85	1.7	.....
28	.....	1.8	1.75	3.4	6.4	3.5	2.4	1.85	1.7	.....
29	2.0	1.8	1.8	3.8	6.0	3.5	2.4	1.8	1.7	.....
30	.....	1.8	1.8	4.2	5.8	3.7	2.4	1.8	1.65	.....
31	.....	1.8	.....	4.4	.....	3.6	2.35	.....	1.65	.....

NOTE.—Gage heights distorted by ice Jan. 1 to Mar. 15.

Daily discharge, in second-feet, of Yellowstone River over Lower Yellowstone dam, at Intake, Mont., for 1911.

[T. F. Hansford, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	6,490	6,740	29,600	42,200	17,700	9,540	6,740	5,760
2	.....	6,240	7,000	30,800	42,200	16,800	9,240	6,740	5,760
3	.....	6,240	7,000	34,300	39,400	18,600	8,940	7,260	5,760
4	.....	6,240	7,000	40,800	38,100	18,600	8,650	7,260	5,300
5	.....	6,240	7,260	42,200	36,800	18,600	8,650	7,260	5,530
6	.....	6,240	7,000	42,200	34,300	17,700	11,500	7,800	5,530
7	.....	6,240	7,000	40,800	33,100	17,700	16,800	7,260	5,530
8	.....	6,000	7,000	43,600	34,300	22,400	24,400	7,260	.....
9	.....	6,000	7,260	45,000	33,100	24,400	20,400	7,260	.....
10	.....	6,000	7,800	56,800	33,100	23,400	14,400	7,260	.....
11	.....	6,000	8,940	59,800	33,100	22,400	12,900	7,260	.....
12	.....	5,760	10,200	55,200	32,000	18,600	10,800	7,000	.....
13	.....	5,760	11,500	52,200	28,600	17,700	9,540	6,740	.....
14	.....	5,760	11,500	49,400	25,400	16,800	9,540	6,740	.....
15	.....	5,760	12,200	55,200	24,400	15,200	8,940	6,740	.....
16	13,600	5,760	12,900	64,400	24,400	14,400	8,650	6,490	.....
17	12,900	5,760	14,000	69,100	22,400	14,000	8,360	6,490	.....
18	11,500	5,530	15,200	73,800	22,400	13,600	7,800	6,240	.....
19	11,500	5,300	17,700	73,800	21,400	12,900	7,800	6,240	.....
20	11,500	5,300	21,400	70,600	21,400	14,400	7,800	6,490	.....
21	11,500	5,080	18,600	69,100	21,400	14,400	7,800	6,490	.....
22	10,800	5,080	16,000	78,400	23,400	12,900	7,800	6,490	.....
23	10,200	5,300	15,200	76,800	23,400	12,200	7,800	6,240	.....
24	8,940	5,300	14,400	73,800	21,400	11,500	7,260	6,240	.....
25	7,800	5,530	12,900	71,400	21,400	10,800	7,260	6,240	.....
26	7,800	5,760	16,000	67,600	21,400	10,800	7,000	6,240	.....
27	7,260	6,490	16,800	61,400	19,500	10,200	7,000	6,240	.....
28	6,740	6,490	17,700	53,800	18,600	10,200	7,000	6,240	.....
29	6,740	6,740	21,400	47,900	18,600	10,200	6,740	6,240	.....
30	6,740	6,740	25,400	45,000	20,400	10,200	6,740	6,000	.....
31	6,740	.....	27,500	.....	19,500	9,850	.....	6,000	.....

Monthly discharge of Yellowstone River over Yellowstone dam, at Intake, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	.....	.....	3,500	215,000
February	.....	.....	4,000	222,000
March	13,600	6,740	9,270	570,000
April	6,740	5,080	5,900	351,000
May	27,500	6,740	12,800	787,000
June	78,400	29,600	55,800	3,320,000
July	42,200	18,600	27,500	1,690,000
August	24,400	9,850	15,500	953,000
September	24,400	6,740	9,900	589,000
October	7,800	6,000	6,680	411,000
November	5,760	.....	4,750	283,000
December	.....	.....	4,000	246,000
The period	78,400	.....	13,300	9,640,000

NOTE.—Means for January, February, and December estimated. Daily discharge Mar. 1 to 15 estimated at 9,000 second-feet; discharge Nov. 8 to 30 at 4,500 second-feet.

Daily discharge, in second-feet, of Lower Yellowstone canal at Lower Yellowstone dam, at Intake, Mont., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	148	417	227	43	66	16	175	274	482	95	0	.....
2	.....	148	417	202	47	66	17	100	185	482	45	30	.....
3	.....	0	417	195	49	45	18	105	295	482	45	30	.....
4	.....	0	440	185	50	42	19	105	295	482	45	30	.....
5	.....	0	440	170	57	42	20	192	295	402	57	43	.....
6	.....	0	455	155	66	147	21	192	295	295	49	53	.....
7	.....	180	466	148	66	147	22	192	343	295	49	53	.....
8	168	180	466	103	0	99	23	192	353	265	48	53	.....
9	168	97	466	103	0	99	24	187	365	265	84	66	.....
10	168	97	466	0	0	40	25	184	377	265	74	66	.....
11	95	97	468	94	0	.....	26	131	313	265	49	66	.....
12	95	127	468	95	0	.....	27	111	123	265	49	66	.....
13	168	210	455	95	0	.....	28	111	377	295	49	66	.....
14	168	255	468	95	0	.....	29	111	353	227	49	66	.....
15	168	255	482	95	0	.....	30	111	390	235	45	75	.....
							31	118	.....	227	57	.....	.....

NOTE.—Estimates of daily discharge of canal furnished by United States Reclamation Service. Canal opened May 8 and closed Oct. 10. No water in canal June 3 to 6, Aug. 10, and Sept. 8 to 16.

Monthly discharge of Lower Yellowstone canal at Lower Yellowstone dam, at Intake, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May 8–31	192	95	146	6,950
June	390	0	214	12,700
July	482	227	388	23,900
August	227	0	92.0	5,660
September	75	0	38.0	2,260
October 1–10	147	40	79.3	1,570
The year	.....	.....	.....	53,000

NORTH FORK OF BIG TIMBER CREEK NEAR BIG TIMBER, MONT.

Location.—In the SE. ¼ SE. ¼ sec. 26, T. 3 N., R. 13 E., 1 mile above the Tintinger ranch, 15 miles northwest of Big Timber, Mont., just above the junction with the South Fork.

Records available.—May 6, 1907, to December 31, 1911.

Drainage area.—40 square miles.

Gage.—Staff on left bank; datum unchanged.

Channel.—Bed composed of bowlders and coarse gravel; probably permanent.

Discharge measurements.—Made by wading.

Winter flow.—Affected by ice.

Diversions.—Several ditches above the station divert water to irrigate approximately 300 acres of land; a large ditch appropriating 50,000 inches of water (including both forks) heads just below the gage. The water rights of Big Timber Creek have never been adjudicated.

Storage.—Two lakes at the head of the North Fork offer excellent reservoir sites. It is proposed to utilize the flow of the North Fork in connection with a project under the Carey Act.

Accuracy.—Results obtained during the open season good.

Discharge measurements of North Fork of Big Timber Creek near Big Timber, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 29	C. S. Heidel	0.91	17.1
May 27	do	1.63	80
July 18	R. Richards	1.48	67
Aug. 24	C. S. Heidel	1.04	24.5

Daily gage height, in feet, of North Fork of Big Timber Creek near Big Timber, Mont., for 1911.

[N. J. Tintinger, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	0.90	1.00	3.0	1.40	1.05	1.00	0.90	0.95
2	.....	.95	.90	3.1	1.30	1.10	1.05	0.90	0.95
3	.....	.90	.90	2.7	1.30	1.10	1.10	0.85	0.95
4	.....	.90	1.00	3.0	1.20	1.20	1.10	0.85	0.95
5	.....	.90	1.00	2.7	1.30	1.20	1.10	0.85	0.95
6	0.85	.90	1.10	2.40	1.40	1.30	1.10	0.85	0.95
7	.85	.90	1.40	2.00	1.40	1.30	1.05	0.85	0.95
8	.70	.90	1.30	2.00	1.30	1.40	1.05	0.80	0.95
9	.75	.95	1.50	2.10	1.30	1.40	1.00	0.80	0.95
10	.75	1.00	1.40	2.00	1.40	1.45	1.00	0.80	0.95
11	.80	1.00	1.40	2.5	1.40	1.50	1.00	0.80	0.95
12	.85	.95	1.30	2.5	1.40	1.45	1.00	0.80	.....
13	.85	.90	1.20	3.0	1.30	1.40	1.00	0.80	.....
14	.80	.85	1.30	2.8	1.40	1.30	1.00	0.80	.....
15	.85	.85	2.70	2.5	1.40	1.30	1.00	0.80	.....
16	.80	.85	2.50	2.40	1.40	1.30	1.00	0.80	.....
17	.85	.85	2.50	2.40	1.40	1.25	.95	0.80	.....
18	.85	.90	2.40	2.00	1.47	1.25	.95	0.80	.....
19	.90	.90	2.20	2.00	1.45	1.20	1.00	0.80	.....
20	.90	.95	1.60	2.40	1.40	1.20	1.00	0.80	.....
21	.85	.95	1.40	2.40	1.40	1.20	.95	0.80	.....
22	.85	1.00	1.60	2.30	1.40	1.15	.95	0.80	.....
23	.90	1.00	1.60	2.20	1.35	1.15	.90	0.80	.....
24	.90	1.00	1.40	2.15	1.30	1.10	.90	0.80	.....
25	.90	1.00	1.60	2.00	1.25	1.05	.90	0.85	.....
26	.85	1.05	1.70	1.85	1.15	1.05	.90	0.85	.....
27	.85	1.05	1.61	1.70	1.10	1.05	.90	0.90	.....
28	.85	1.05	1.61	1.70	1.20	1.05	.95	0.90	.....
29	.91	1.00	1.70	1.65	1.30	1.05	.95	0.90	.....
30	.91	1.00	1.70	1.45	1.10	1.05	.95	0.95	.....
31	.90	.....	1.70	.....	1.00	1.00	.....	0.95	.....

NOTE.—Gage heights distorted by ice Oct. 25 to Nov. 11.

Daily discharge, in second-feet, of North Fork of Big Timber Creek near Big Timber, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	17	22	460	53	25	22	17
2	.....	20	17	490	43	28	25	17
3	.....	17	17	370	43	28	28	15
4	.....	17	22	460	35	35	28	15
5	.....	17	22	370	43	35	28	15
6	15	17	28	280	53	43	28	15
7	15	17	53	165	53	43	25	15
8	10	17	43	165	43	53	25	13
9	12	20	65	190	43	53	22	13
10	12	22	53	165	53	59	22	13
11	13	22	53	310	53	65	22	13
12	15	20	43	310	53	59	22	13
13	15	17	35	460	43	53	22	13
14	13	15	43	400	53	43	22	13
15	15	15	370	310	53	43	22	13
16	13	15	310	280	53	43	22	13
17	15	15	310	280	53	39	20	13
18	15	17	280	165	61	39	20	13
19	17	17	220	165	59	35	22	13
20	17	20	80	280	53	35	22	13
21	15	20	53	280	53	35	20	13
22	15	22	80	250	53	32	20	13
23	17	22	80	220	48	32	17	13
24	17	22	53	205	43	28	17	13
25	17	22	80	165	39	25	17	15
26	15	25	97	128	32	25	17	15
27	15	25	82	97	28	25	17	15
28	15	25	82	97	35	25	20	15
29	18	22	97	88	43	25	20	15
30	18	22	97	59	28	25	20	15
31	17	.....	97	.....	22	22	.....	15

NOTE.—Daily discharge determined from a fairly well defined rating curve; discharge estimated Oct. 25 to 31.

Monthly discharge of North Fork of Big Timber Creek near Big Timber, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 10	615	D.
February	.....	.....	[a] 10	555	D.
March	18	10	15.0	922	C.
April	25	15	19.4	1,150	B.
May	370	17	96.3	5,920	B.
June	490	59	255	15,200	B.
July	61	22	45.8	2,820	B.
August	65	22	37.3	2,290	B.
September	28	17	21.8	1,300	B.
October	17	13	14.0	861	C.
November	.....	.....	[a] 12	714	D.
December	.....	.....	[a] 9	553	D.
The year	490	.....	45.4	32,900	

[a] Estimated.

NOTE.—Discharge Mar. 1 to 5 estimated at 15 second-feet per day.

SOUTH FORK OF BIG TIMBER CREEK NEAR BIG TIMBER, MONT.

Location.—In the SE. ¼ SE. ¼ sec. 26, T. 3 N., R. 13 E., 1 mile above Tintinger's ranch, just above the junction with the North Fork, and 15 miles northwest of Big Timber, Mont.

Records available.—May 6, 1907, to December 31, 1911.

Drainage area.—10 square miles.

Gage.—Staff; datum unchanged.

Channel.—Practically permanent.

Discharge measurements.—Made by wading near gage.

Winter flow.—Affected by ice.

Diversions.—A few ditches divert water from the creek, and practically all the water is appropriated.

Accuracy.—Open-season results fairly good.

Discharge measurements of South Fork of Big Timber Creek near Big Timber, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 29	C. S. Heidel	0.51	8.3
May 27	do	.99	50
July 18	R. Richards	.75	31
Aug. 24	C. S. Heidel	.64	15.4

Daily gage height, in feet, of South Fork of Big Timber Creek near Big Timber, Mont., for 1911.

[N. J. Tintinger, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	0.55	0.5	1.5	0.85	0.5	0.6	0.55	0.5
2	.....	.5	.5	1.5	.8	.5	.6	.55	.5
3	.....	.5	.6	1.6	.8	.55	.65	.55	.5
4	.....	.5	.65	1.6	.7	.6	.65	.5	.5
5	.....	.5	.65	1.7	.8	.6	.65	.5	.5
6	0.5	.5	.65	1.6	.85	.65	.65	.5	.5
7	.5	.5	.7	1.5	.85	.8	.6	.5	.5
8	.5	.5	.7	1.4	.8	1.0	.6	.5	.5
9	.5	.5	.75	1.4	.7	.9	.6	.5	.5
10	.55	.55	.7	1.4	.8	.85	.6	.5	.5
11	.5	.55	.65	1.5	.7	.8	.6	.5	.5
12	.5	.5	.6	1.6	.65	.8	.6	.5	.....
13	.55	.45	.6	1.6	.7	.75	.6	.5	.....
14	.5	.45	.65	1.6	.7	.75	.6	.5	.....
15	.5	.45	1.4	1.5	.7	.65	.6	.5	.....
16	.55	.45	1.0	1.5	.65	.65	.6	.5	.....
17	.5	.5	.9	1.4	.65	.6	.55	.5	.....
18	.55	.5	.8	1.0	.75	.6	.55	.5	.....
19	.65	.5	.7	1.0	.7	.6	.55	.5	.....
20	.6	.55	.7	1.3	.7	.6	.6	.5	.....
21	.55	.55	.6	1.3	.65	.6	.6	.5	.....
22	.65	.6	.75	1.2	.65	.65	.55	.5	.....
23	.65	.6	1.0	1.2	.65	.6	.55	.5	.....
24	.65	.6	1.0	1.1	.65	.65	.5	.55	.....
25	.6	.65	1.0	1.0	.6	.65	.5	.5	.....
26	.55	.65	1.1	.95	.55	.6	.5	.5	.....
27	.55	.6	1.1	.95	.55	.6	.55	.5	.....
28	.55	.6	1.05	.9	.6	.6	.55	.5	.....
29	.51	.65	1.15	.85	.6	.6	.55	.5	.....
30	.51	.6	1.1	.85	.55	.6	.55	.5	.....
31	.5	.....	1.05	.....	.5	.55	.....	.5	.....

Daily discharge, in second-feet, of South Fork of Big Timber Creek near Big Timber, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	7.0	9.5	7.0	162	34	7.0	12	9.5	7.0
2	7.0	7.0	7.0	162	29	7.0	12	9.5	7.0
3	7.0	7.0	12	190	29	9.5	16	9.5	7.0
4	7.0	7.0	16	190	20	12	16	7.0	7.0
5	7.0	7.0	16	220	29	12	16	7.0	7.0
6	7.0	7.0	16	190	34	16	16	7.0	7.0
7	7.0	7.0	20	162	34	29	12	7.0	7.0
8	7.0	7.0	20	136	29	54	12	7.0	7.0
9	7.0	7.0	24	136	20	40	12	7.0	7.0
10	9.5	9.5	20	136	29	34	12	7.0	7.0
11	7.0	9.5	16	162	20	29	12	7.0	7.0
12	7.0	7.0	12	190	16	29	12	7.0	.....
13	9.5	5.2	12	190	20	24	12	7.0	.....
14	7.0	5.2	16	190	20	24	12	7.0	.....
15	7.0	5.2	136	162	20	16	12	7.0	.....
16	9.5	5.2	54	162	16	16	12	7.0	.....
17	7.0	7.0	40	136	16	12	9.5	7.0	.....
18	9.5	7.0	29	54	24	12	9.5	7.0	.....
19	16	7.0	20	54	20	12	9.5	7.0	.....
20	12	9.5	20	113	20	12	12	7.0	.....
21	9.5	9.5	12	113	16	12	12	7.0	.....
22	16	12	24	91	16	16	9.5	7.0	.....
23	16	12	54	91	16	12	9.5	7.0	.....
24	16	12	54	72	16	16	7.0	9.5	.....
25	12	16	54	54	12	16	7.0	7.0	.....
26	9.5	16	72	47	9.5	12	7.0	7.0	.....
27	9.5	12	72	47	9.5	12	9.5	7.0	.....
28	9.5	12	63	40	12	12	9.5	7.0	.....
29	7.5	16	82	34	12	12	9.5	7.0	.....
30	7.5	12	72	34	9.5	12	9.5	7.0	.....
31	7.0	.....	63	.....	7.0	9.5	.....	7.0	.....

NOTE.—Daily discharge determined from a rating curve fairly well defined below 54 second-feet.

Monthly discharge of South Fork of Big Timber Creek near Big Timber, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 5.00	307	D.
February	.....	.....	[a] 5.00	278	D.
March	16	7.0	9.16	563	B.
April	16	5.2	9.08	540	B.
May	136	7.0	36.6	2,250	B.
June	220	34	124	7,380	C.
July	34	7.0	19.8	1,220	B.
August	54	7.0	17.7	1,090	B.
September	16	7.0	11.3	672	B.
October	9.5	7.0	7.32	450	B.
November	7.0	7.0	7.00	417	C.
December	.....	.....	[a] 5.00	307	D.
The year	.....	.....	21.3	15,500	

[a] Estimated.

NOTE.—Discharge Mar. 1 to 5 and Nov. 12 to 30 estimated at 7 second-feet.

BOULDER RIVER NEAR CONTACT, MONT.

Location.—In the SE. ¼ sec. 14, T. 3 S., R. 12 E., at the ranch of G. W. Baker, about 8 miles above McLeod post office, 4 miles from Contact, Mont., and 2½ miles below the Boulder Falls.

Records available.—May 1, 1910, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff, fastened to left abutment of private wagon bridge near the ranch buildings.

Channel.—Rocky; permanent.

Discharge measurements.—Made from the bridge or by wading just above the footbridge, which is some 400 yards above the gage.

Winter flow.—Affected by ice.

Accuracy.—Good.

Discharge measurements of Boulder River near Contact, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 31	C. S. Heidel	2.20	61
May 23	do	3.5	504
July 14	R. Richards	4.02	850
Aug. 25	C. S. Heidel	2.76	198

Daily gage height, in feet, of Boulder River near Contact, Mont., for 1911.

[G. W. Baker, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	2.15	2.29	2.85	5.0	5.5	3.75	2.55	2.6	2.45
2	2.15	2.26	2.90	5.8	5.6	3.65	2.55	2.65	2.45
3	2.15	2.26	2.92	5.8	5.2	3.55	2.55	2.65	2.45
4	2.15	2.24	2.92	5.6	5.4	3.5	2.55	2.65	2.45
5	2.15	2.24	3.0	6.1	5.4	3.4	2.55	2.65	2.45
6	2.16	2.24	3.1	5.9	5.4	3.4	2.5	2.65	2.4
7	2.16	2.24	3.2	6.3	5.6	3.3	2.5	2.65	2.4
8	2.18	2.24	3.3	6.7	5.5	3.3	2.5	2.65	2.4
9	2.18	2.25	3.4	7.2	4.8	3.2	2.5	2.65	2.4
10	2.21	2.25	3.45	6.8	4.6	3.2	2.45	2.7	2.4
11	2.21	2.2	3.6	7.5	4.4	3.1	2.45	2.7	2.4
12	2.24	2.2	3.7	8.1	4.2	3.1	2.45	2.7	.....
13	2.24	2.2	3.75	8.0	4.2	3.0	2.45	2.7	.....
14	2.24	2.2	3.85	8.3	4.2	3.0	2.45	2.7	.....
15	2.24	2.2	3.85	8.0	4.2	3.0	2.45	2.65	.....
16	2.24	2.2	3.75	6.9	4.1	3.0	2.45	2.65	.....
17	2.26	2.25	3.65	7.2	4.1	3.0	2.5	2.65	.....
18	2.26	2.25	3.65	6.8	4.1	2.9	2.5	2.65	.....
19	2.26	2.2	3.55	7.1	4.0	2.9	2.5	2.65	.....
20	2.26	2.2	3.55	7.4	4.5	2.8	2.52	2.6	.....
21	2.26	2.2	3.5	7.5	4.1	2.8	2.54	2.6	.....
22	2.26	2.3	3.6	7.6	4.0	2.7	2.55	2.55	.....
23	2.29	2.3	3.65	6.8	3.9	2.7	2.55	2.55	.....
24	2.29	2.4	3.75	6.5	3.9	2.7	2.54	2.5	.....
25	2.29	2.5	3.85	6.4	3.9	2.65	2.6	2.5	.....
26	2.29	2.6	3.95	6.2	3.85	2.65	2.6	2.5	.....
27	2.29	2.65	4.0	6.0	3.75	2.6	2.6	2.5	.....
28	2.29	2.75	4.0	5.9	3.75	2.6	2.6	2.5	.....
29	2.29	2.75	3.75	5.8	3.65	2.6	2.62	2.45	.....
30	2.29	2.75	3.75	5.6	3.65	2.6	2.62	2.45	.....
31	2.20	.....	3.9	.....	4.0	2.6	.....	2.45	.....

Daily discharge, in second-feet, of Boulder River near Contact, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	52	78	228	1,520	1,870	675	138	150	112
2	52	72	245	2,080	1,940	615	138	165	112
3	52	72	253	2,080	1,660	558	138	165	112
4	52	68	253	1,940	1,800	530	138	165	112
5	52	68	285	2,290	1,800	475	138	165	112
6	54	68	330	2,150	1,800	475	125	165	100
7	54	68	375	2,430	1,940	425	125	165	100
8	57	68	425	2,720	1,870	425	125	165	100
9	57	70	475	3,070	1,380	375	125	165	100
10	62	70	502	2,790	1,240	375	112	180	100
11	62	60	585	3,290	1,100	330	112	180	100
12	68	60	645	3,710	960	330	112	180	.....
13	68	60	675	3,640	960	285	112	180	.....
14	68	60	735	3,850	960	285	112	180	.....
15	68	60	735	3,640	960	285	112	165	.....
16	68	60	675	2,860	895	285	112	165	.....
17	72	70	615	3,070	895	285	125	165	.....
18	72	70	615	2,790	895	245	125	165	.....
19	72	60	558	3,000	830	245	125	165	.....
20	72	60	558	3,210	1,170	210	130	150	.....
21	72	60	530	3,290	895	210	135	150	.....
22	72	80	585	3,360	830	180	138	138	.....
23	78	80	615	2,790	765	180	138	138	.....
24	78	100	675	2,580	765	180	135	125	.....
25	78	125	735	2,500	765	165	150	125	.....
26	78	150	798	2,360	735	165	150	125	.....
27	78	165	830	2,220	675	150	150	125	.....
28	78	195	830	2,150	675	150	150	125	.....
29	78	195	675	2,080	615	150	156	112	.....
30	78	195	675	1,940	615	150	156	112	.....
31	60	.....	765	.....	830	150	.....	112	.....

NOTE.—Daily discharge determined from a rating curve well defined below 1,200 second-feet.

Monthly discharge of Boulder River near Contact, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	30	1,840	D.
February	.....	.....	35	1,940	D.
March	78	52	66.5	4,090	A.
April	195	60	88.9	5,290	A.
May	830	228	564	34,700	A.
June	3,850	1,520	2,710	161,000	C.
July	1,940	615	1,130	69,500	B.
August	675	150	308	18,900	A.
September	156	112	131	7,800	A.
October	180	112	153	9,410	A.
November	.....	.....	96	5,710	C.
December	.....	.....	65	4,000	D.
The year	.....	.....	448	324,000	

NOTE.—Means for January, February, and December estimated. Discharge Nov. 12 to 30 estimated at 90 second-feet.

WEST FORK OF BOULDER RIVER AT McLEOD, MONT.

Location.—In the SE. ¼ sec. 16, T. 2 S., R. 13 E., at Koozer's private bridge, 200 hundred yards upstream from the highway bridge at McLeod post office.

Records available.—May 4, 1907, to December 31, 1911.

Drainage area.—137 square miles.

Gage.—Staff, fastened to piling of bridge near right bank; datum unchanged.

Channel.—Composed of bowlders; rough but permanent.

Discharge measurements.—Made from bridge or by wading.

Winter flow.—Affected by ice.

Diversions.—Water to irrigate about 800 acres of land is diverted above the station. A Carey Act project reclaiming 12,000 to 15,000 acres is now under investigation; the water is to be diverted from the West Fork about 12 miles above the station.

Accuracy.—Open-water records good.

Discharge measurements of West Fork of Boulder River at McLeod, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 31	C. S. Heidel	1.48	51
May 24	do	2.67	411
July 15	R. Richards	2.48	345
Aug. 25	C. S. Heidel	1.67	70

Daily gage height, in feet, of West Fork of Boulder River at McLeod, Mont., for 1911.

[Clyde Curtis, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.45	1.8	3.6	2.9	2.05	1.6	1.6	1.65
2	.....	1.4	1.85	3.9	2.8	2.1	1.6	1.65	1.65
3	.....	1.4	1.85	3.7	2.7	2.25	1.7	1.6	1.6
4	.....	1.45	1.85	3.6	2.8	2.15	1.65	1.6	1.6
5	.....	1.5	1.9	3.4	3.0	2.15	1.7	1.65	1.6
6	.....	1.5	2.0	3.4	2.8	2.0	1.6	1.6	1.55
7	.....	1.45	2.05	3.5	3.0	2.0	1.6	1.65	1.55
8	.....	1.5	2.2	3.6	2.9	2.15	1.65	1.65	1.55
9	.....	1.45	2.4	3.5	2.5	2.05	1.6	1.65	1.6
10	.....	1.4	2.45	3.9	2.45	2.05	1.65	1.7	1.55
11	.....	1.5	2.6	4.0	2.45	2.0	1.6	1.65	1.55
12	.....	1.45	2.6	4.2	2.45	1.9	1.6	1.7	1.5
13	.....	1.45	2.5	4.3	2.45	1.95	1.7	1.65	1.5
14	.....	1.4	2.6	3.8	2.45	1.85	1.65	1.65	1.5
15	1.3	1.4	2.7	3.9	2.35	1.85	1.65	1.7	1.5
16	1.3	1.45	2.5	3.8	2.2	1.8	1.6	1.65	.....
17	1.3	1.45	2.4	3.7	2.2	1.7	1.6	1.7	.....
18	1.35	1.5	2.35	3.7	2.2	1.75	1.6	1.65	.....
19	1.35	1.5	2.3	3.8	2.2	1.7	1.55	1.65	.....
20	1.4	1.55	2.2	3.9	2.35	1.75	1.6	1.7	.....
21	1.4	1.55	2.2	3.8	2.25	1.7	1.6	1.65	.....
22	1.45	1.55	2.25	3.7	2.2	1.65	1.6	1.7	.....
23	1.5	1.55	2.25	3.5	2.2	1.7	1.65	1.65	.....
24	1.5	1.6	2.7	3.4	2.1	1.65	1.6	1.65	.....
25	1.5	1.65	2.8	3.4	2.1	1.7	1.6	1.7	.....
26	1.45	1.65	2.7	3.4	2.5	1.65	1.55	1.65	.....
27	1.45	1.7	2.7	3.4	2.1	1.65	1.55	1.7	.....
28	1.5	1.7	2.8	3.3	2.1	1.65	1.65	1.6	.....
29	1.45	1.75	3.0	3.2	2.0	1.6	1.6	1.6	.....
30	1.4	1.8	3.1	3.0	2.05	1.65	1.65	1.65	.....
31	1.45	.....	3.0	.....	2.0	1.6	.....	1.6	.....

Daily discharge, in second-feet, of West Fork of Boulder River at McLeod, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	50	105	1,010	545	178	69	69	77
2	.....	45	118	1,280	490	195	69	77	77
3	.....	45	118	1,100	440	248	85	69	69
4	.....	50	118	1,010	490	213	77	69	69
5	.....	56	130	860	600	213	85	77	69
6	.....	56	160	860	490	160	69	69	62
7	.....	50	178	935	600	160	69	77	62
8	.....	56	230	1,010	545	213	77	77	62
9	.....	50	305	935	345	178	69	77	69
10	.....	45	325	1,280	325	178	77	85	62
11	.....	56	390	1,370	325	160	69	77	62
12	.....	50	390	1,570	325	130	69	85	56
13	.....	50	345	1,670	325	145	85	77	56
14	.....	45	390	1,180	325	118	77	77	56
15	36	45	440	1,280	285	118	77	85	56
16	36	50	345	1,180	230	105	69	77	.....
17	36	50	305	1,100	230	85	69	85	.....
18	40	56	285	1,100	230	95	69	77	.....
19	40	56	265	1,180	230	85	62	77	.....
20	45	62	230	1,280	285	95	69	85	.....
21	45	62	230	1,180	248	85	69	77	.....
22	50	62	248	1,100	230	77	69	85	.....
23	56	62	248	935	230	85	77	77	.....
24	56	69	440	860	195	77	69	77	.....
25	56	77	490	860	195	85	69	85	.....
26	50	77	440	860	345	77	62	77	.....
27	50	85	440	860	195	77	62	85	.....
28	56	85	490	790	195	77	77	69	.....
29	50	95	600	725	160	69	69	69	.....
30	45	105	660	600	178	77	77	77	.....
31	50	.....	600	.....	160	69	.....	69	.....

NOTE.—Daily discharge determined from a rating curve well defined below 600 second-feet.

Monthly discharge of West Fork of Boulder River at McLeod, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 20	1,230	
February	.....	.....	[a] 20	1,110	
March	56	.....	37.0	2,280	C.
April	105	45	60.1	3,580	B.
May	660	105	324	19,900	B.
June	1,670	600	1,060	63,100	C.
July	600	160	322	19,800	B.
August	248	69	127	7,810	B.
September	85	62	72.0	4,280	B.
October	85	69	77.3	4,750	B.
November	77	.....	54.6	3,250	C.
December	.....	.....	[a] 35	2,150	
The year	1,670	.....	185	133,000	

[a] Estimated.

NOTE.—Discharge Mar. 1 to 14 estimated at 25 second-feet per day; Nov. 16 to 30, estimated at 45 second-feet.

SWEETGRASS CREEK ABOVE MELVILLE, MONT.

Location.—In the SW. ¼ sec. 24, T. 5 N., R. 12 E., at C. M. Rein's ranch, 17 miles northwest of Melville and 35 miles from Big Timber, at the site of a reservoir proposed under the Carey Act.

Records available.—May 5, 1907, to September 30, 1911.

Drainage area.—47 square miles (total for stream).

Gage.—A staff nailed to lower side (right bank) of a footbridge directly behind the ranch buildings. When the station was established a secondary staff gage to be used during extreme high water was installed about 300 feet below the regular gage and at a different datum. The regular gage was undermined during the high water of June and July, 1908, and readings were discontinued August 19 of that year. The present gage, which is the old secondary gage, has been read since October 1, 1908. The gage heights on the new gage are not comparable with those read on the old gage.

Channel.—Composed of rough gravel.

Discharge measurements.—Made by wading near gage at ordinary stages; at high stages made from footbridge.

Winter flow.—Stream freezes over during winter months.

Diversions.—Two small ditches divert water above the station.

Discharge measurements of Sweetgrass Creek above Melville, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 29	C. S. Heidel	1.45	10.7
May 23	do	2.32	220
July 17	R. Richards	2.15	127
Aug. 8	C. S. Heidel	1.90	59.3

Daily gage height, in feet, of Sweetgrass Creek above Melville, Mont., for 1911.

[C. M. Rein, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	.....	1.50	3.9	.....	2.00	1.85	16	1.48	1.45	2.95	2.90	2.15	1.98	1.75
2	.....	1.45	1.50	4.6	2.32	2.00	1.82	17	1.48	1.43	2.50	2.90	2.15	1.97	.....
3	.....	.....	1.50	3.9	2.32	2.00	1.82	18	1.48	1.42	2.38	2.90	2.15	1.97	1.74
4	.....	.....	1.52	3.7	2.38	2.00	1.80	19	1.48	1.42	2.29	3.25	2.15	1.97	.....
5	.....	.....	1.52	3.00	2.38	2.00	.....	20	1.50	1.45	2.18	3.10	2.15	1.95	1.74
6	.....	.....	1.52	2.90	2.40	2.00	.....	21	1.50	1.45	2.10	3.05	2.15	1.95	1.73
7	.....	1.45	1.52	3.40	2.42	2.00	1.80	22	1.50	1.58	2.10	3.00	2.10	1.93	.....
8	.....	1.45	1.52	3.10	2.45	2.00	.....	23	1.50	1.55	2.12	2.80	2.10	1.93	1.73
9	.....	1.45	1.52	3.00	2.38	2.02	1.80	24	1.49	1.55	2.2	2.70	2.10	1.90	1.73
10	.....	1.45	1.53	3.00	2.40	2.04	1.78	25	1.48	1.50	2.3	2.50	2.10	1.90	1.72
11	.....	1.45	1.53	3.45	2.32	2.01	1.78	26	.....	.....	2.32	2.38	2.08	1.90	.....
12	.....	.....	1.53	3.55	2.25	2.00	1.75	27	.....	.....	2.22	2.38	2.08	1.87	1.72
13	.....	.....	1.58	3.6	2.20	2.00	.....	28	.....	.....	2.2	2.45	2.05	1.87	.....
14	.....	.....	2.85	3.30	2.20	2.00	1.75	29	1.45	.....	2.2	2.42	2.05	1.85	1.72
15	.....	.....	3.55	3.10	2.20	1.98	.....	30	1.45	.....	2.2	2.38	2.05	1.85	1.70
								31	1.45	.....	2.35	.....	2.00	1.85	.....

Daily discharge, in second-feet, of Sweetgrass Creek above Melville, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	10	13	950	188	83	51	16	12	10	475	420	125	79	34
2	.....	10	13	1,340	177	83	46	17	12	10	269	420	125	76	34
3	.....	10	13	930	177	83	46	18	12	8.6	222	420	125	76	33
4	.....	10	15	820	198	83	42	19	12	8.6	189	595	125	76	33
5	.....	10	15	470	198	83	42	20	13	10	152	520	125	71	33
6	.....	10	15	420	205	83	42	21	13	10	127	495	125	71	32
7	.....	10	15	670	213	83	42	22	13	20	127	470	110	67	32
8	.....	10	15	520	225	83	42	23	13	18	133	375	110	67	32
9	.....	10	15	470	198	88	42	24	12	18	158	330	110	60	32
10	.....	10	16	470	205	94	39	25	12	13	192	245	110	60	30
11	.....	10	16	695	177	86	39	26	11	13	199	198	105	60	30
12	.....	10	16	745	155	83	34	27	10	13	165	198	105	55	30
13	.....	10	20	770	140	83	34	28	10	13	158	225	96	55	30
14	.....	10	425	620	140	83	34	29	10	13	158	213	96	51	30
15	.....	10	775	520	140	79	34	30	10	13	158	198	96	51	27
								31	10	.....	210	.....	83	51	.....

NOTE.—Daily discharge determined from rating curves as follows: Mar. 16 to June 2, 1910, curve well defined; June 3 to Sept. 30, curve fairly well defined; discharge interpolated for days for which gage heights are missing.

Monthly discharge of Sweetgrass Creek above Melville, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 12	738	D.
February	.....	.....	[a] 12	666	D.
March	13	.....	11.8	726	C.
April	20	8.6	11.4	678	D.
May	775	13	145	8,920	A.
June	1,340	198	524	31,200	C.
July	225	83	145	8,920	B.
August	94	51	73.7	4,530	B.
September	51	27	36.0	2,140	B.
The period	.....	.....	.....	58,500	

[a] Estimated.

SWEETGRASS CREEK BELOW MELVILLE, MONT.

Location.—At McAllister's ranch, just above the head of the canal owned by the Glass-Lindsay Land Co.

Records available.—May 4, 1907 (at Adam's ranch site), to April 1, 1909; new site April 1, 1909, to August 31, 1911.

Drainage area.—Total for stream, 47 square miles.

Gage.—Staff, on left bank near observer's house; the original gage was located 2½ miles below the headgate of the Glass-Lindsay Land Co.'s canal, 9 miles below Melville and 20 miles from Big Timber. The present gage was installed April 1, 1909, when the old station was discontinued.

Channel.—Bed composed of clean gravel; nonshifting.

Discharge measurements.—Made by wading.

Winter flow.—Affected by ice.

Diversions and storage.—Many diversions are made from this stream. All the low-water flow is appropriated, 550 second-feet being held by adjudicated rights. The Glass-Lindsay canal will carry 575 second-feet and irrigate 30,000 acres; the canal will divert water into two storage reservoirs with capacities of 12,000 and 6,000 feet, respectively, which will be filled from the spring run-off.

Accuracy.—Records good.

Discharge measurements of Sweetgrass Creek below Melville, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 28	C. S. Heidel	1.12	35.8
May 25	do	2.24	342
July 17	R. Richards	1.35	83
Aug. 23	C. S. Heidel	1.19	57.8

Daily gage height, in feet, of Sweetgrass Creek below Melville, Mont., for 1911.

[Alexander Harper, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Day.	Mar.	Apr.	May.	June.	July.	Aug.
1	.....	1.15	1.10	2.60	1.45	1.25	16	.....	1.12	3.90	2.50	1.35	1.25
2	.....	1.15	1.10	3.55	1.50	1.25	17	.....	1.10	3.75	2.45	1.35	1.25
3	.....	1.10	1.10	3.00	1.45	1.25	18	.....	1.10	2.00	2.50	1.35	1.28
4	.....	1.10	1.00	2.72	1.50	1.25	19	.....	1.10	1.50	2.45	1.35	1.25
5	.....	1.10	.95	2.60	1.50	1.28	20	.....	1.10	1.52	2.40	1.30	1.25
6	.....	1.15	1.00	2.40	1.45	1.35	21	.....	1.15	1.50	2.38	1.25	1.25
7	.....	1.10	1.10	2.35	1.45	1.25	22	.....	1.18	1.45	2.42	1.25	1.25
8	.....	1.10	1.12	2.85	1.35	1.32	23	.....	1.00	1.50	2.45	1.25	1.20
9	.....	1.10	1.15	2.52	1.35	1.35	24	.....	1.00	2.10	2.50	1.25	1.10
10	.....	1.10	1.08	2.40	1.40	1.35	25	.....	1.00	2.25	2.45	1.30	1.10
11	.....	1.10	1.15	2.58	1.35	1.35	26	.....	.95	2.45	2.35	1.25	1.10
12	.....	1.10	1.15	2.58	1.35	1.35	27	.....	1.05	2.00	2.05	1.25	.....
13	.....	1.10	1.15	2.55	1.35	1.35	28	1.12	1.10	1.62	1.70	1.25	.....
14	.....	1.10	2.45	2.50	1.35	1.35	29	1.25	1.10	1.50	1.58	1.3	.....
15	.....	1.15	2.65	2.45	1.40	1.28	30	1.22	1.10	1.45	1.50	1.25	.....
							31	1.22	.....	1.50	.....	1.25	.....

Daily discharge, in second-feet, of Sweetgrass Creek below Melville, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Day.	Mar.	Apr.	May.	June.	July.	Aug.
1	.....	36	31	550	102	66	16	.....	33	1,560	490	82	66
2	.....	36	31	1,260	112	66	17	.....	31	1,430	460	82	66
3	.....	31	31	800	102	66	18	.....	31	250	490	82	70
4	.....	31	23	622	112	66	19	.....	31	112	460	82	66
5	.....	31	19	550	112	70	20	.....	31	117	430	73	66
6	.....	36	23	430	102	82	21	.....	36	112	420	66	66
7	.....	31	31	405	102	66	22	.....	38	102	442	66	66
8	.....	31	33	700	82	77	23	.....	23	112	460	66	58
9	.....	31	36	502	82	82	24	.....	23	290	490	66	45
10	.....	31	29	430	91	82	25	.....	23	255	460	73	45
11	.....	31	36	538	82	82	26	.....	19	460	405	66	45
12	.....	31	36	538	82	82	27	.....	27	250	270	66	.....
13	.....	31	36	520	82	82	28	33.	31	140	161	66	.....
14	.....	31	440	490	82	82	29	46	31	112	130	73	.....
15	.....	36	562	460	91	70	30	42	31	102	112	66	.....
							31	42	.....	112	.....	66	.....

NOTE.—Discharge determined from rating curves as follows: Mar. 28 to May 17 (1910), curve well defined; May 18 to Aug. 1, from rating curve fairly well defined.

Monthly discharge of Sweetgrass Creek below Melville, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January			30	1,840	D.
February			25	1,390	D.
March			21.8	1,340	D.
April	38	19	30.8	1,830	A.
May	1,560	19	223	13,700	B.
June	1,260	112	482	28,700	B.
July	112	66	82.5	5,070	B.
August	82	45	64.7	3,980	B.
The period				57,800	

NOTE.—Means for January and February estimated. Discharge Mar. 1 to 27 estimated at 25 second-feet per day, and Aug. 27 to 31 at 45 second-feet.

STILLWATER RIVER NEAR NYE, MONT.

Location.—In W. ½ SW. ¼ sec. 28, T. 5 S., R. 15 E., directly back of B. F. Wood's ranch, 1 mile below Woodbine Creek, and 7 miles from the junction of the West Fork.

Records available.—One discharge measurement during 1911.

Drainage area.—187 square miles.

Gage.—Standard chain.

Channel.—Rock, probably permanent.

Discharge measurements.—Made by wading or from cable.

Winter flow.—Affected by ice.

Diversion.—None of importance.

The following discharge measurement was made by C. S. Heidel:
August 29, 1911: Gage height, 3.98 feet; discharge, 213 second-feet.

STILLWATER RIVER NEAR ABSAROKEE, MONT.

Location.—On the public highway bridge crossing the stream at the Riverside Road house, 13 miles southwest of Columbus, Mont., and about 1 mile northeast of Absarokee, Mont.; below the mouth of Rosebud Creek.

Records available.—July 19, 1910, to October 31, 1911.

Drainage area.—Not measured.

Gage.—Staff gage nailed to right abutment pier on upstream side of bridge.

Channel.—Bed of stream is very rough, being composed of gravel and bowlders, but will not shift.

Discharge measurements.—Made from the lower side of the bridge.

Winter flow.—Affected by ice.

Diversions.—The territory bordering Stillwater River is well irrigated by water taken from the river.

Discharge measurements of Stillwater River near Absarokee, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 18	W. A. Lamb	1.93	1,170	Aug. 30	C. S. Heidel	1.18	724
July 13	R. Richards	3.00	2,350	Nov. 6	B. E. Jones	.42	318
Aug. 15	B. E. Jones	2.05	1,230	6	do	.42	318
16	do	2.02	1,240				

Daily gage height, in feet, of Stillwater River near Absarokee, Mont., for 1911.

[A. B. Tenney, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.68	3.6	2.5	1.2	0.75	.....	16	.....	5.2	3.0	2.0	1.0	0.55	.....
2	.....	4.2	3.6	2.6	1.2	.75	.....	17	.....	5.1	3.2	1.95	.85	.55	.....
3	.....	3.9	3.4	2.4	1.2	.75	.....	18	1.9	5.4	3.2	2.0	.9	.6	.....
4	.....	4.2	3.5	2.2	1.3	.65	.....	19	1.8	5.4	3.2	2.0	.9	.55	.....
5	.....	3.9	3.7	2.3	1.3	.55	.....	20	1.6	5.1	2.9	1.9	.9	.45	.....
6	.....	3.9	4.0	2.6	1.35	.6	0.4	21	1.43	5.4	3.1	1.85	.85	.55	.....
7	.....	4.1	4.0	2.6	1.35	.65	.5	22	1.43	5.2	3.0	1.65	.75	.6	.....
8	.....	4.6	4.2	2.5	1.25	.7	.....	23	1.5	5.1	2.9	1.65	.68	.6	.....
9	.....	4.6	3.6	2.4	1.25	.65	.48	24	2.0	4.5	2.8	1.6	.8	.6	.....
10	.....	4.2	3.1	2.3	1.1	.55	.....	25	2.1	4.1	2.7	1.4	.85	.6	.....
11	.....	4.6	3.2	2.4	1.15	.6	.48	26	2.6	3.9	2.8	1.3	.9	.6	.....
12	.....	5.0	3.2	2.2	1.1	.6	.....	27	2.3	3.6	2.9	1.2	.8	.28	.....
13	.....	5.9	2.9	1.95	1.0	.6	.....	28	2.2	4.0	2.8	1.3	.9	.55	.....
14	.....	6.2	3.1	1.85	1.05	.6	.....	29	2.2	3.7	2.6	1.13	.8	.....	.....
15	.....	5.6	2.9	1.95	0.95	.6	.....	30	2.2	3.5	2.5	1.15	.7	.....	.....
								31	2.1	.....	2.28	1.13	.....	.....	.....

Daily discharge, in second-feet, of Stillwater River near Absarokee, Mont., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	3,170	3,070	1,760	670	445	.....	16	.....	5,110	2,350	1,240	570	352
2	.....	3,810	3,070	1,870	670	445	.....	17	.....	4,980	2,590	1,200	495	352
3	.....	3,430	2,830	1,650	670	445	.....	18	1,150	5,370	2,590	1,240	520	375
4	.....	3,810	2,950	1,430	720	398	.....	19	1,070	5,370	2,590	1,240	520	352
5	.....	3,430	3,190	1,540	720	352	.....	20	920	4,980	2,230	1,150	520	310
6	.....	3,430	3,550	1,870	750	375	290	21	801	5,370	2,470	1,110	495	352
7	.....	3,680	3,550	1,870	750	398	330	22	801	5,110	2,350	955	445	375
8	.....	4,330	3,810	1,760	695	420	.....	23	850	4,980	2,230	955	411	375
9	.....	4,330	3,070	1,650	695	398	322	24	1,240	4,200	2,110	920	470	375
10	.....	3,810	2,470	1,540	620	352	.....	25	1,330	3,680	1,990	780	495	375
11	.....	4,330	2,590	1,650	645	375	322	26	1,870	3,430	2,110	720	520	375
12	.....	4,850	2,590	1,430	620	375	.....	27	1,540	3,070	2,230	670	470	249
13	.....	6,020	2,230	1,200	570	375	.....	28	1,430	3,550	2,110	720	520	352
14	.....	6,410	2,470	1,110	595	375	.....	29	1,430	3,190	1,870	635	470	340
15	.....	5,630	2,230	1,200	545	375	.....	30	1,430	2,950	1,760	645	420	330
								31	1,330	.....	1,520	635	.....	320

NOTE.—Daily discharge determined from a fairly well defined rating curve; discharge estimated for days for which gage heights are missing.

Monthly discharge of Stillwater River near Absarokee, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May 18-31	1,870	801	1,230	34,100	B.
June	6,410	2,950	4,330	258,000	C.
July	3,810	1,520	2,540	156,000	B.
August	1,870	635	1,240	76,200	B.
September	750	411	576	34,300	B.
October	445	249	370	22,800	B.
November	.....	.....	305	18,100	C.
December	.....	.....	250	15,400	D.
The period	.....	.....	.....	615,000	

NOTE.—Mean for December estimated. Discharge Nov. 12 to 30 estimated at 300 second-feet.

WOODBINE CREEK NEAR NYE, MONT.

Location.—Gage is located 7 miles south of Nye, Mont., in the SE. ¼ sec. 32, T. 5 S., R. 15 E., approximately a quarter of a mile from the junction of this creek and the Stillwater River.

Records available.—Two measurements during 1911.

Gage.—Sloping staff.

Channel.—Large rocks; very rough.

Discharge measurements.—Made by wading.

Winter flow.—Affected by ice.

Diversion.—None.

Measurements are made at this station to determine the amount of water available for power. In the first mile from its mouth the creek has a fall of 900 feet, and there is at present an application for development of its power.

Discharge measurements of Woodbine Creek near Nye, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
1911.		*Feet.*	*Sec.-ft.*
Aug. 12	B. E. Jones	3.05	47
29	C. S. Heidel	2.70	31

ROSEBUD RIVER AT ABSAROKEE, MONT.

Location.—In SW. ¼ SE. ¼ sec. 36, T. 3 S., R 18 W., on the highway bridge just west of Absarokee, Mont., and 14 miles from Columbus, about 1 mile above the stream's junction with Stillwater River.

Records available.—July 19, 1910, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Staff, on downstream side of left abutment pier.

Channel.—Bed of stream is composed of gravel and bowlders and is not likely to shift.

Discharge measurements.—Made from the downstream side of the bridge.

Winter flow.—Affected by ice.

Diversions.—Water for irrigation is diverted above the station.

Discharge measurements of Rosebud River at Absarokee, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 18	W. A. Lamb	2.60	452
July 13	R. Richards	3.03	798
Aug. 16	B. E. Jones	2.85	647
30	C. S. Heidel	2.44	386
Nov. 7	B. E. Jones	1.81	147

Daily gage height, in feet, of Rosebud River at Absarokee, Mont., for 1911.

[Chris. Carstens, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.0	2.2	4.0	4.0	3.5	2.5	2.9
2	.....	2.0	2.1	3.9	3.6	3.5	2.5	2.9
3	.....	2.0	2.1	3.7	3.6	3.5	2.5	2.9
4	.....	2.0	2.1	3.6	3.7	3.6	2.5	2.9
5	.....	2.0	2.2	3.4	3.2	3.6	2.6	2.9
6	.....	2.0	2.2	3.2	4.0	3.5	2.7	2.9
7	.....	2.0	2.2	3.05	4.0	3.5	2.7	2.9
8	.....	2.0	2.2	3.6	3.9	3.3	2.7	2.9
9	.....	1.8	2.3	3.8	3.8	3.2	2.7	2.9
10		1.8	2.3	3.7	3.6	3.2	2.6	2.9
11	.....	1.8	2.4	4.0	3.4	3.2	2.6	2.9
12	1.5	1.9	2.4	4.2	3.4	3.2	2.5	.....
13	1.5	1.9	2.5	4.5	3.3	3.1	2.5	.....
14	1.6	1.9	2.7	4.4	3.4	3.1	2.5	.....
15	1.7	1.9	3.2	4.8	3.4	3.0	2.5	.....
16	1.7	1.8	2.7	5.0	3.4	2.85	2.5	.....
17	3.2	1.8	2.6	4.0	3.4	2.8	2.7	.....
18	2.1	1.8	2.6	4.4	3.5	2.8	2.7	.....
19	2.2	1.8	2.5	4.6	3.7	2.8	2.8	.....
20	2.1	1.9	2.5	4.5	3.7	2.8	2.8	.....
21	2.1	1.9	2.5	4.5	3.9	2.7	2.8	.....
22	2.1	1.9	2.7	4.3	4.0	2.7	2.9	.....
23	2.0	1.9	2.6	4.1	4.0	2.7	2.9	.....
24	2.0	1.9	2.9	4.0	3.8	2.6	2.9	.....
25	2.0	1.9	3.0	4.0	3.7	2.6	2.9	.....
26	2.0	2.0	3.2	4.0	3.7	2.6	2.9	.....
27	2.0	2.0	3.25	4.1	3.6	2.6	2.9	.....
28	2.0	2.1	3.2	4.2	3.4	2.6	2.9	.....
29	2.0	2.2	3.3	4.0	3.4	2.55	2.9	.....
30	2.0	2.2	3.4	4.0	3.4	2.55	2.9	.....
31	2.0	.....	4.0	.....	3.4	2.55	.....	.....

NOTE.—Gage heights Sept. 17 to Oct. 11 believed to be erroneous.

Daily discharge, in second-feet, of Rosebud River at Absarokee, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	190	260	2,350	2,350	1,470	410
2	.....	190	225	2,150	1,630	1,470	410
3	.....	190	225	1,800	1,630	1,470	410
4	.....	190	225	1,630	1,800	1,630	410
5	.....	190	260	1,320	1,050	1,630	480
6	.....	190	260	1,050	2,350	1,470	550
7	.....	190	260	875	2,350	1,470	550
8	.....	190	260	1,630	2,150	1,180	550
9	.....	135	300	1,970	1,970	1,050	550
10	.....	135	300	1,800	1,630	1,050	480
11	.....	135	350	2,350	1,320	1,050	480
12	90	160	350	2,750	1,320	1,050	410
13	90	160	410	3,350	1,180	930	410
14	100	160	550	3,150	1,320	930	410
15	115	160	1,050	4,020	1,320	820	410
16	115	135	550	4,500	1,320	675	410
17	300	135	480	2,350	1,320	630	.....
18	225	135	480	3,150	1,470	630	.....
19	260	135	410	3,580	1,800	630	.....
20	225	160	410	3,350	1,800	630	.....
21	225	160	410	3,350	2,150	550	.....
22	225	160	550	2,950	2,350	550	.....
23	190	160	480	2,550	2,350	550	.....
24	190	160	720	2,350	1,970	480	.....
25	190	160	820	2,350	1,800	480	.....
26	190	190	1,050	2,350	1,800	480	.....
27	190	190	1,120	2,550	1,630	480	.....
28	190	225	1,050	2,750	1,320	480	.....
29	190	260	1,180	2,350	1,320	445	.....
30	190	260	1,320	2,350	1,320	445	.....
31	190	.....	2,750	.....	1,320	445	.....

NOTE.—Daily discharge determined from a rating curve well defined below 1,500 second-feet.

Monthly discharge of Rosebud River at Absarokee, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March 12-31	300	90	184	7,300	B.
April	260	135	173	10,300	B.
May	2,750	225	615	37,800	B.
July	4,500	875	2,500	149,000	B
June	2,350	1,050	1,690	104,000	B.
August	1,630	445	879	54,000	B.
September 1-16	550	410	478	14,500	B.
The period				377,000	

CLARK FORK AT FROMBERG, MONT.

Location.—In sec. 21, T. 5 S., R. 23 E., at the highway bridge half a mile east of the Northern Pacific Railway station at Fromberg, Mont.

Records available.—June 3, 1905, to December 31, 1911.

Drainage area.—2,500 square miles.

Gage.—A standard chain fastened to upstream side of bridge; datum unchanged. The original gage was a staff; its datum was the same as that of the chain gage.

Channel.—Bed of stream composed of rock and gravel; free from vegetation; permanent. Channel divided by middle pier of bridge.

Discharge measurements.—Made from bridge.

Winter flow.—Affected by ice from December to the middle of March.

Diversions.—Many diversions are made from the river, but only a small portion of the total flow is used.

Accuracy.—Records excellent.

The following discharge measurement was made by B. E. Jones:

August 9, 1911: Gage height, 4.63 feet; discharge, 1,170 second-feet.

Daily gage height, in feet, of Clark Fork at Fromberg, Mont., for 1911.

[Mrs. E. V. Moran, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.5	3.9	6.0	7.7	5.4	3.8	3.7	3.7
2	.....	3.5	3.9	6.3	7.7	5.2	3.8	3.7	3.7
3	.....	3.6	4.1	6.6	7.5	5.0	3.8	3.7	3.8
4	.....	3.6	4.3	7.1	7.1	4.9	3.7	3.7	3.8
5	3.6	3.6	4.3	7.1	6.7	5.0	3.7	3.7	3.75
6	3.55	3.6	4.3	6.9	6.6	5.0	3.7	3.7	3.75
7	3.6	3.6	4.7	6.9	6.6	4.5	3.7	3.7	3.7
8	3.6	3.6	4.9	7.5	6.7	4.5	3.7	3.7	3.7
9	3.6	3.7	5.0	8.1	6.9	4.5	3.7	3.7	3.7
10	3.6	3.7	5.3	8.2	5.9	4.5	3.7	3.7	.....
11	3.5	3.7	5.3	8.4	5.8	4.2	3.7	3.7	.....
12	3.5	3.7	5.5	8.6	5.7	4.25	3.7	3.7	.....
13	3.5	3.6	5.5	8.9	5.7	4.2	3.7	3.7	.....
14	3.5	3.7	5.8	8.7	5.7	4.2	3.7	3.7	.....
15	3.5	3.7	6.2	8.8	5.5	4.2	3.7	3.7	.....
16	3.5	3.7	6.2	8.9	5.5	4.2	3.7	3.7	.....
17	3.4	3.6	6.2	8.6	5.5	4.2	3.7	3.7	.....
18	3.4	3.6	6.3	8.5	5.4	4.2	3.7	3.7	.....
19	3.4	3.6	6.5	8.5	5.1	4.2	3.7	3.7	.....
20	3.4	3.6	6.3	8.5	5.0	4.2	3.7	3.7	.....
21	3.4	3.6	6.1	8.4	5.0	4.1	3.75	3.7	.....
22	3.4	3.7	6.3	8.3	5.0	4.0	3.8	3.7	.....
23	3.4	4.1	5.9	8.2	4.9	4.0	3.8	3.7	.....
24	3.5	3.6	5.5	7.9	5.0	4.0	3.7	3.7	.....
25	3.5	3.6	5.5	7.6	5.0	4.0	3.7	3.7	.....
26	3.5	3.7	6.4	7.6	5.0	3.9	3.7	3.7	.....
27	3.4	3.7	6.4	7.6	5.4	3.9	3.7	3.7	.....
28	3.5	3.7	6.0	7.8	5.3	3.9	3.7	3.7	.....
29	3.5	3.6	5.9	7.8	5.0	3.9	3.7	3.7	.....
30	3.5	3.8	5.9	7.6	5.0	3.9	3.7	3.55	.....
31	3.5	.....	5.9	.....	5.4	3.9	.....	3.7	.....

Daily discharge, in second-feet, of Clark Fork at Fromberg, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	300	325	555	2,860	6,230	2,040	490	430	430
2	325	325	555	3,360	6,230	1,800	490	430	430
3	350	375	700	3,880	5,740	1,560	490	430	490
4	350	375	860	4,840	4,840	1,440	430	430	490
5	375	375	860	4,840	4,060	1,560	430	430	460
6	350	375	860	4,440	3,880	1,560	430	430	460
7	375	375	1,230	4,440	3,880	1,040	430	430	430
8	375	375	1,440	5,740	4,060	1,040	430	430	430
9	375	430	1,560	7,330	4,440	1,040	430	430	430
10	375	430	1,920	7,620	2,710	1,040	430	430	.....
11	325	430	1,920	8,210	2,560	780	430	430	.....
12	325	430	2,160	8,810	2,420	820	430	430	.....
13	325	375	2,160	9,710	2,420	780	430	430	.....
14	325	430	2,560	9,110	2,420	780	430	430	.....
15	325	430	3,180	9,410	2,160	780	430	430	.....
16	325	430	3,180	9,710	2,160	780	430	430	.....
17	275	375	3,180	8,810	2,160	780	430	430	.....
18	275	375	3,360	8,510	2,040	780	430	430	.....
19	275	375	3,700	8,510	1,680	780	430	430	.....
20	275	375	3,360	8,510	1,560	780	430	430	.....
21	275	375	3,020	8,210	1,560	700	460	430	.....
22	275	430	3,360	7,910	1,560	625	490	430	.....
23	275	700	2,710	7,620	1,440	625	490	430	.....
24	325	375	2,160	6,760	1,560	625	430	430	.....
25	325	375	2,160	5,980	1,560	625	430	430	.....
26	325	430	3,520	5,980	1,560	555	430	430	.....
27	275	430	3,520	5,980	2,040	555	430	430	.....
28	325	430	2,860	6,490	1,920	555	430	430	.....
29	325	375	2,710	6,490	1,560	555	430	430	.....
30	325	490	2,710	5,980	1,560	555	430	350	.....
31	325	.....	2,710	.....	2,040	555	.....	430	.....

NOTE.—Daily discharge determined from a rating curve well defined between 200 and 8,000 second-feet. Discharge Mar. 1 to 4 estimated.

Monthly discharge of Clark Fork at Fromberg, Mont., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 250	15,400	D.
February	.....	.....	[a] 275	15,300	D.
March	375	275	322	19,800	A.
April	700	325	406	24,200	A.
May	3,700	555	2,280	140,000	A.
June	9,710	2,860	6,870	409,000	A.
July	6,230	1,440	2,770	170,000	A.
August	2,040	555	919	56,500	A.
September	490	430	441	26,200	A.
October	430	350	427	26,300	A.
November	490	.....	415	24,700	C.
December	.....	.....	[a] 300	18,400	D.
The year	9,710	.....	1,310	946,000	

[a] Estimated.

NOTE.—Discharge Nov. 10 to 30 estimated at 400 second-feet.

PRYOR CREEK NEAR PRYOR, MONT.

Location.—Three hundred feet above head gate of Pryor ditch, in sec. 21, T. 5 S., R. 25 E., about 2 miles from Pryor, Mont.

Records available.—September 12, 1911, to April 1, 1912, when station was discontinued. One measurement in 1911.

Drainage area.—Not measured.

Gage.—Vertical staff gage attached to a tree on the right bank of the stream, 300 feet above the headworks of Pryor ditch.

Channel.—Practically permanent; bottom of the stream is composed of gravel and cobblestone.

Discharge measurements.—Made by wading at the gage.

Winter flow.—Stream freezes solid at gage during the winter months.

Diversion.—No diversion above the gage.

The following discharge measurement was made by W. A. Lamb:

September 12, 1911: Gage height, 1.41 feet; discharge, 4.8 second-feet.

PRYOR CREEK NEAR COBURN, MONT.

Location.—At the ranch of John A. Hoyt, near Coburn, Mont., near south line of T. 1 S., R. 27 E.

Records available.—September 13, 1911, to December 31, 1911.

Gage.—Overhanging chain gage on left bank opposite the farm house of John A. Hoyt.

Channel.—Permanent. The bed of the stream at the gage is composed of gravel and sand, but at the control both above and below it is firm gravel and cobblestones. At low stages the water is deep and sluggish at the gage and for several hundred feet above and below.

Discharge measurement.—Made by wading above the gage.

Winter flow.—Channel is blocked with ice during winter months.

Diversion.—Water sufficient to irrigate approximately 1,000 acres near Pryor, about 30 miles above this station.

The following discharge measurement was made by W. A. Lamb:

September 13, 1911: Gage height, 4 feet; discharge, 23 second-feet.

Daily gage height, in feet, of Pryor Creek near Coburn, Mont., for 1911.

[John A. Hoyt, observer.]

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	4.00	4.02	4.04	16	4.00	4.00	4.02	4.02
2	.....	4.00	4.02	4.04	17	4.00	4.00	4.02	.....
3	.....	4.00	4.01	4.04	18	4.00	4.00	4.02	.....
4	.....	4.00	4.01	4.04	19	4.00	4.02	4.03	.....
5	.....	4.00	4.01	4.04	20	4.01	4.02	4.03	.....
6	.....	4.00	4.01	4.04	21	4.00	4.02	4.04	.....
7	.....	4.00	4.01	4.04	22	4.01	4.02	4.04	.....
8	.....	4.00	4.01	4.04	23	4.01	4.01	4.04	.....
9	.....	4.00	4.01	4.04	24	4.02	4.01	4.04	4.03
10	.....	4.00	4.02	4.02	25	4.02	4.01	4.04	4.03
11	.....	4.00	4.02	4.02	26	4.01	4.01	4.04	4.03
12	.....	4.00	4.02	4.02	27	4.01	4.01	4.04	4.03
13	.....	4.00	4.02	4.02	28	4.00	4.01	4.04	4.03
14	4.01	4.00	4.02	4.02	29	4.00	4.03	4.04	4.03
15	4.00	4.00	4.02	4.02	30	4.00	4.03	4.04	4.03
					31	.....	4.03	.....	.....

PRYOR CREEK AT HUNTLEY, MONT.

Location.—In the SW. ¼ sec. 25, T. 2 N., R. 27 E., at the steel highway bridge half a mile from the railroad station at Huntley.

Records available.—August 6, 1904, to December 31, 1911.

Drainage area.—800 square miles.

Gage.—Chain; installed June 16, 1906, at the highway bridge crossing the new channel, into which the creek was at that time turned by the United States Reclamation Service; datum unchanged since 1906.

Channel.—Bed composed of clay and gravel and may change somewhat; banks steep and uniformly graded, clean, and not subject to overflow; current moderate.

Discharge measurements.—Made from the bridge to which the gage is attached.

Winter flow.—Stream freezes over during the winter months.

Discharge measurements of Pryor Creek at Huntley, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 12	W. A. Lamb	1.38	45	Aug. 10	B. E. Jones	1.31	26
12	do	1.38	47	Sept. 11	R. Richards	1.20	18
July 25	B. E. Jones	0.90	5.5	Nov. 16	W. A. Lamb	1.35	23.3
25	do	0.90	6.0				

Daily gage height, in feet, of Pryor Creek at Huntley, Mont., for 1911.

[Arthur Foster, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.40	4.8	4.2	1.52	1.40	1.50	1.10	0.95	1.15	1.10	1.30	1.40
2	1.50	4.8	4.2	1.48	1.40	1.75	1.10	0.88	1.20	1.10	1.30	1.40
3	1.50	4.8	4.2	1.48	1.40	1.50	1.10	1.02	1.15	1.20	1.30	1.40
4	1.60	4.8	4.2	1.45	1.38	1.50	1.08	1.05	1.20	.....	1.50	1.40
5	1.70	4.5	4.2	1.45	1.38	1.45	1.05	0.95	1.15	.....	1.50	1.40
6	1.70	4.2	4.8	1.42	1.38	1.35	1.04	1.00	1.20	.....	1.60	1.40
7	1.90	4.2	5.2	1.42	1.35	1.35	1.00	.....	1.15	.....	1.65	1.40
8	2.10	4.2	7.2	1.42	1.35	1.30	1.00	.....	1.20	.....	1.65	1.40
9	2.75	4.10	.....	1.42	1.35	3.20	1.00	.....	1.20	.....	1.85	1.38
10	2.75	4.0	.....	1.40	1.35	1.75	1.00	.....	1.20	.....	1.85	1.38
11	2.75	4.0	.....	1.40	1.35	1.55	1.00	.....	1.20	.....	1.85	1.38
12	2.75	4.2	2.60	1.40	1.32	1.50	1.00	.....	1.20	.....	1.85	1.35
13	2.75	4.0	2.15	1.40	1.32	1.40	0.90	.....	1.20	.....	1.85	1.35
14	2.75	4.2	2.00	1.40	1.30	1.40	0.88	.....	1.20	.....	1.85	1.35
15	2.75	4.3	2.00	1.40	1.30	1.40	0.88	1.15	1.20	.....	1.85	1.35
16	2.75	4.3	1.80	1.38	1.30	1.40	0.88	1.20	1.20	1.31	.....	1.35
17	2.75	4.6	1.70	1.35	1.35	1.35	0.88	1.10	1.18	1.30	1.35	1.40
18	2.75	4.6	1.50	1.35	1.30	2.10	0.88	1.10	1.18	1.30	1.40	1.42
19	2.75	4.6	1.50	1.35	1.32	1.45	0.90	1.10	1.20	1.30	1.40	1.50
20	2.75	4.6	1.60	1.40	1.32	1.25	0.85	1.05	1.18	1.28	1.45	1.50
21	2.75	4.3	1.50	1.40	1.30	1.25	0.92	1.10	1.18	1.28	1.50	1.53
22	2.75	4.3	1.50	1.40	1.30	1.20	0.90	1.05	1.18	1.28	1.50	1.58
23	2.75	4.3	1.50	1.40	1.28	1.20	0.95	1.10	1.25	1.28	1.45	1.60
24	2.75	4.1	1.50	1.45	1.28	1.18	0.98	1.05	1.23	1.28	1.45	1.70
25	2.75	4.1	1.50	1.50	1.32	1.15	0.88	1.15	1.20	1.30	1.40	1.70
26	2.75	4.1	1.50	1.50	1.50	1.18	1.05	1.20	1.20	1.30	1.40	1.70
27	2.75	4.1	1.50	1.50	1.80	1.15	1.00	1.15	1.18	1.31	1.35	1.70
28	2.75	4.1	1.80	1.45	2.00	1.15	1.04	1.22	1.15	1.28	1.30	1.70
29	2.75	.....	1.75	1.40	1.60	1.15	1.00	1.20	1.15	1.30	1.35	1.65
30	3.8	.....	1.70	1.40	1.15	1.05	0.95	1.15	1.15	1.30	1.40	1.65
31	6.7	.....	1.70	.....	1.55	.....	0.95	1.20	.....	1.30	.....	1.65

NOTE.—Gage height distorted by ice Jan. 1 to Mar. 12 and Nov. 4 to Dec. 31.

Daily discharge, in second-feet, of Pryor Creek at Huntley, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	22	59	47	57	20	6	13	8	20
2	22	55	47	85	20	2	17	8	20
3	22	55	47	57	20	9	13	15	20
4	22	52	45	57	18	6	17	15	.....
5	22	52	45	52	16	3	13	15	.....
6	30	49	45	42	15	5	17	16	.....
7	50	42	42	42	12	10	13	16	.....
8	100	49	42	38	12	15	17	17	.....
9	125	49	42	272	12	20	17	17	.....
10	150	47	42	85	12	26	17	18	.....
11	175	47	42	62	12	23	17	18	.....
12	194	47	40	57	12	21	16	19	.....
13	136	47	40	47	6.0	19	16	19	.....
14	116	47	38	47	5.2	16	16	20	.....
15	116	47	38	47	5.2	13	16	21	.....
16	91	45	38	47	5.2	17	16	22	.....
17	79	42	42	42	5.2	9	15	21	.....
18	57	42	38	129	5.2	9	15	21	.....
19	57	42	40	52	6.0	9	16	21	.....
20	68	47	40	34	4.0	6	15	20	.....
21	57	47	38	34	7.2	9	15	20	.....
22	57	47	38	29	6.0	6	15	20	.....
23	57	47	36	29	9.0	9	19	20	.....
24	57	52	36	27	11	6	17	20	.....
25	57	57	40	24	5.2	13	15	21	.....
26	57	57	57	27	15	17	15	20	.....
27	57	57	91	24	11	13	14	21	.....
28	91	52	116	24	14	19	11	18	.....
29	85	47	68	24	11	17	11	20	.....
30	79	47	24	16	6	13	11	20	.....
31	79	.....	62	.....	6	17	.....	20	.....

NOTE.—Daily discharge determined as follows: Mar. 12 to July 25, from curve parallel to 1910 curve but poorly defined; July 25 to Aug. 9 and Sept. 12 to Nov. 3, by indirect method for shifting channels; Aug. 10 to Sept. 11, from curve poorly defined. Discharge interpolated for days for which gage heights are missing.

Monthly discharge of Pryor Creek at Huntley, Mont., for 1911.

[Drainage area, 800 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a] 20	0.025	0.03	1,230	
February	.....	.....	[a] 22	.028	.03	1,220	
March	194	22	77	.096	.11	4,730	C.
April	59	42	49.3	.062	.07	2,930	C.
May	116	24	46.6	.058	.07	2,870	C.
June	272	16	53.6	.067	.07	3,190	C.
July	20	4	10.5	.013	.02	646	C.
August	26	2	12.4	.016	.02	762	C.
September	19	11	15.2	.019	.02	904	C.
October	22	8	18.3	.023	.03	1,130	C.
November	.....	.....	[a] 20	.025	.03	1,190	
December	.....	.....	[a] 20	.025	.03	1,230	
The year	272	2	30.4	.038	.53	22,000	

[a] Estimated.

WIND RIVER AT DUBOIS, WYO.

Location.—At Dubois, in sec. 7, T. 41 N., R. 106 W., just below the mouth of Horse Creek, the nearest tributary.

Records available.—August 4, 1910, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Data too meager to determine.

Discharge measurements.—Made by wading.

Winter flow.—Springs keep the river open during the winter months.

Diversions.—A number of irrigation ditches divert water above the station.

Accuracy.—Sufficient discharge measurements have not been made to afford a basis for estimates of flow.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of Wind River at Dubois, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 7	O. M. Wimmer	6.15	318
9	do	6.55	444
Nov. 5	H. B. Waha	5.90	174

Daily gage height, in feet, of Wind River at Dubois, Wyo., for 1910.

[Earl French, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Day.	Aug.	Sept.	Oct.	Nov.
1	.....	5.85	5.8	5.8	16	5.9	5.8	5.8	5.7
2	.....	5.85	5.8	5.8	17	5.95	5.8	5.8	5.9
3	.....	5.85	5.8	5.8	18	5.9	5.8	5.8	5.95
4	6.0	5.85	5.8	5.8	19	5.9	5.8	5.8	5.9
5	6.0	5.85	5.8	5.6	20	5.9	5.8	5.8	5.95
6	5.95	5.85	5.8	5.7	21	5.85	5.8	5.8	5.95
7	5.95	5.8	5.8	5.85	22	5.9	5.85	5.8	5.85
8	5.95	5.8	5.8	5.8	23	5.85	5.85	5.8	5.75
9	5.95	5.85	5.8	5.8	24	5.85	5.8	5.8	5.8
10	5.95	5.85	5.8	5.8	25	5.8	5.8	5.8	5.8
11	5.9	5.85	5.8	5.75	26	5.85	5.85	5.8	5.75
12	6.0	5.9	5.8	5.75	27	5.85	5.85	5.8	5.75
13	6.0	5.9	5.9	5.75	28	5.85	5.8	5.7	5.7
14	5.95	5.85	5.8	5.7	29	5.85	5.75	5.7	5.75
15	5.95	5.85	5.8	5.65	30	5.85	5.75	5.65	5.85
					31	5.85	.....	5.7	

Daily gage height, in feet, of Wind River at Dubois, Wyo., for 1911.

[Earl French, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.70	5.55	5.55	5.65	5.70	7.90	8.05	6.50	5.95	5.98	5.68	5.80
2	5.80	5.55	5.55	5.70	5.80	8.25	7.95	6.45	5.95	6.10	5.70	5.75
3	5.70	5.60	5.55	5.75	5.75	8.15	7.75	6.40	5.95	6.05	5.82	5.75
4	5.70	5.60	5.55	5.70	5.80	8.35	7.85	6.38	5.95	6.02	5.88	5.80
5	5.50	5.60	5.55	5.60	6.00	8.60	7.80	6.35	5.98	6.00	5.92	5.85
6	5.50	5.60	5.55	5.60	6.20	8.65	7.80	6.30	6.08	6.00	5.80	5.85
7	5.50	5.60	5.60	5.60	6.15	8.85	7.70	6.30	6.05	6.00	5.70	5.90
8	5.50	5.55	5.55	5.60	6.20	9.20	7.75	6.32	6.05	5.98	5.92	5.90
9	5.55	5.60	5.55	5.60	6.50	9.05	7.45	6.28	6.02	5.95	5.88	5.85
10	5.50	5.55	5.55	5.60	6.32	8.40	7.25	6.25	6.00	5.95	5.90	5.85
11	5.50	5.55	5.55	5.60	6.18	8.85	7.30	6.25	6.00	5.95	5.88	5.85
12	5.55	5.55	5.60	5.60	6.20	9.30	7.25	6.25	6.02	5.95	5.88	5.80
13	5.55	5.57	5.60	5.65	6.42	9.85	7.20	6.22	6.15	5.95	5.82	5.80
14	5.55	5.60	5.65	5.65	6.50	9.55	7.15	6.22	6.05	5.95	5.88	5.80
15	5.55	5.55	5.65	5.65	6.95	9.70	7.18	6.18	6.02	5.95	5.90	5.80
16	5.60	5.55	5.65	5.65	6.95	10.20	7.20	6.18	6.00	5.92	5.90	5.80
17	5.50	5.50	5.55	5.65	6.82	10.05	7.17	6.15	5.98	5.88	5.88	5.88
18	5.55	5.50	5.65	5.65	6.68	10.60	7.10	6.15	5.95	5.82	5.90	5.80
19	5.55	5.55	5.65	5.70	6.55	9.95	7.10	6.12	5.95	5.72	5.85	5.80
20	5.55	5.50	5.65	5.65	6.40	9.90	6.98	6.10	5.98	5.70	5.88	5.80
21	5.50	5.50	5.65	5.70	6.35	9.85	6.92	6.12	5.98	5.75	5.85	5.80
22	5.50	5.50	5.60	5.65	6.50	9.50	6.92	6.08	5.95	5.80	5.88	5.80
23	5.55	5.50	5.65	5.65	6.58	9.00	6.88	6.05	5.95	5.82	5.85	5.80
24	5.60	5.50	5.65	5.65	6.85	8.85	6.75	6.02	5.95	5.82	5.85	5.80
25	5.60	5.50	5.65	5.65	7.05	8.45	6.78	6.00	5.95	5.85	5.82	5.80
26	5.60	5.50	5.60	5.80	7.20	8.35	6.80	6.02	5.95	5.82	5.80	5.80
27	5.60	5.50	5.65	5.90	6.95	8.20	6.75	6.02	5.95	5.75	5.75	5.80
28	5.60	5.50	5.70	5.80	6.70	8.10	6.65	6.00	5.95	5.70	5.75	5.80
29	5.60	.....	5.65	5.90	6.82	8.05	6.60	5.98	5.95	5.70	5.80	5.80
30	5.60	.....	5.65	5.80	6.80	8.15	6.58	5.95	5.95	5.68	5.80	5.80
31	5.60	.....	5.65	.....	7.12	.....	6.60	5.95	.....	5.68	.....	5.80

WIND RIVER AT RIVERTON, WYO.

Location.—At highway bridge in sec. 2, T. 1 S., R. 4 E., three-fourths of a mile east of Riverton and three-fourths of a mile above its junction with Little Wind River.

Records available.—May 15 to November 11, 1911. From May 14, 1906, to November 1, 1908, a station was maintained at Walker's ferry, about 1 mile above the present station. As no streams enter between, the records at the two points are comparable.

Drainage area.—2,090 square miles (measured from Land Office map).

Gage.—Chain gage.

Channel.—Shifting after high water.

Discharge measurements.—Made from bridge.

Winter flow.—Ice causes backwater during the winter months.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions of 34 second-feet from Wind River above the station, and of 91 second-feet from tributaries entering above.

Accuracy.—Conditions are favorable for accurate results and the estimates should be reliable.

Cooperation.—Station maintained in cooperation with the State engineer.

Discharge measurements of Wind River at Riverton, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 15	Fletcher and Kingdon	6.00	1,460	July 1	R. H. Fletcher	8.41	5,960
June 7	E. O. Christiansen	7.90	4,930	19	do	7.80	4,450
10	do	8.50	5,920	Oct. 16	G. H. Russell	4.73	508
17	do	10.50	11,100				

Daily gage height, in feet, of Wind River at Riverton, Wyo., for 1911.

[Frances Feris, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	6.70	8.50	6.55	5.40	4.82	4.52	16	6.40	9.80	7.60	6.05	4.95	4.73	.....
2	.....	7.30	8.40	6.55	5.40	4.95	4.54	17	6.25	10.10	7.70	6.05	4.92	4.70	.....
3	.....	7.50	8.10	6.45	5.45	5.05	4.66	18	6.05	10.10	7.80	6.00	4.88	4.70	.....
4	.....	7.60	8.00	6.35	5.65	4.98	4.58	19	5.98	10.30	7.80	6.10	4.78	4.68	.....
5	.....	7.90	8.10	6.20	5.60	4.92	4.50	20	5.70	10.20	7.70	6.10	4.78	4.68	.....
6	.....	8.10	8.20	6.30	5.55	4.96	4.50	21	5.50	10.00	7.60	6.10	4.72	4.55	.....
7	.....	8.20	8.30	6.15	5.55	4.92	4.51	22	5.40	10.00	7.60	6.10	4.62	4.40	.....
8	.....	8.50	8.40	6.00	5.55	4.92	4.48	23	5.50	9.90	7.50	6.05	4.65	4.55	.....
9	.....	8.60	8.20	5.90	5.40	4.82	4.48	24	5.80	9.70	7.30	5.90	4.69	4.61	.....
10	.....	8.40	8.10	5.90	5.30	4.92	4.54	25	6.15	9.40	7.30	5.80	4.68	4.60	.....
11	.....	8.00	7.70	5.95	5.10	4.88	4.48	26	6.40	8.80	7.20	5.70	4.70	4.60	.....
12	.....	8.30	7.60	5.95	4.90	4.80	.....	27	6.50	8.60	7.20	5.60	4.68	4.62	.....
13	.....	9.00	7.50	6.00	4.92	4.77	.....	28	6.30	8.60	7.00	5.50	4.68	4.61	.....
14	.....	9.50	7.50	6.00	4.91	4.72	.....	29	6.10	8.40	6.85	5.40	4.66	4.58	.....
15	6.10	9.50	7.50	5.95	4.98	4.72	.....	30	6.00	8.40	6.65	5.40	4.72	4.52	.....
								31	6.10	.....	6.70	5.30	.....	4.51	.....

Daily discharge, in second-feet, of Wind River at Riverton, Wyo., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2,470	6,080	2,240	895	559	437
2	.....	3,540	5,850	2,240	895	620	444
3	.....	3,940	5,200	2,080	932	672	489
4	.....	4,150	4,990	1,940	1,100	635	458
5	.....	4,780	5,200	1,730	1,050	605	430
6	.....	5,200	5,410	1,870	1,030	625	430
7	.....	5,410	5,630	1,660	1,030	605	434
8	.....	6,080	5,850	1,470	1,030	605	424
9	.....	6,310	5,410	1,350	895	559	424
10	.....	5,850	5,200	1,350	825	605	444
11	.....	4,990	4,360	1,410	700	586	424
12	.....	5,630	4,150	1,410	595	550	.....
13	.....	7,270	3,940	1,470	605	536	.....
14	.....	8,520	3,940	1,470	600	514	.....
15	1,600	8,520	3,940	1,410	635	514	.....
16	2,010	9,280	4,150	1,540	620	518	.....
17	1,800	10,100	4,360	1,540	605	505	.....
18	1,540	10,100	4,570	1,470	586	505	.....
19	1,350	10,600	4,570	1,600	441	497	.....
20	1,140	10,300	4,360	1,600	441	497	.....
21	970	9,800	4,150	1,600	514	448	.....
22	895	9,800	4,150	1,600	473	400	.....
23	970	9,540	3,940	1,540	485	448	.....
24	1,240	9,020	3,540	1,350	501	469	.....
25	1,660	8,270	3,540	1,240	497	465	.....
26	2,010	6,790	3,350	1,140	505	465	.....
27	2,160	6,310	3,350	1,050	497	473	.....
28	1,870	6,310	2,980	970	497	469	.....
29	1,600	5,850	2,720	895	489	458	.....
30	1,470	5,850	2,390	895	514	437	.....
31	1,600	.....	2,470	825	.....	434	.....

NOTE.—Daily discharge determined from a well-defined rating curve.

Monthly discharge of Wind River at Riverton, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off.	Accuracy.
	Maximum.	Minimum.	Mean.	Total in acre-feet.	
May 15-31	2,160	895	1,520	51,300	A.
June	10,600	2,470	7,020	418,000	A.
July	6,080	2,390	4,310	265,000	A.
August	2,240	825	1,480	91,000	A.
September	1,100	441	683	40,600	A.
October	672	400	525	32,300	A.
November 1-11	489	424	439	9,890	A.
December	.....	.....	.....	.....	
The period	.....	.....	.....	908,000	

BIGHORN RIVER AT THERMOPOLIS, WYO.

Location.—In sec. 19, T. 43 N., R. 95 W., on the public highway bridge between Thermopolis and the Thermopolis Hot Springs.

Records available.—May 28, 1900, to December 31, 1905; June 30, 1910, to December 31, 1911.

Drainage area.—8,180 square miles.

Gage.—Staff, fastened securely to the downstream side of the middle pier; datum unchanged.

Channel.—The bed of the stream is composed of rock and gravel, and is practically permanent.

Discharge measurements.—Made from the highway bridge.

Winter flow.—Little affected by ice.

Diversions.—Irrigation is carried on extensively on the tributaries of Bighorn River, but not from the river itself.

Discharge measurements of Bighorn River at Thermopolis, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 24	W. A. Lamb	2.05	1,690
June 23	R. Richards	10.05	15,400
Aug. 2	B. E. Jones	2.38	2,330
3	.....do	2.39	2,340
Oct. 28	.....do	1.10	748

Daily gage height, in feet, of Bighorn River at Thermopolis, Wyo., for 1911.

[Samuel Nelson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.0	1.4	1.0	1.4	2.6	5.1	2.2	1.2	0.75	0.95
2	.....	1.0	1.4	1.0	1.3	2.8	5.4	2.4	1.3	0.75	0.95
3	.....	1.0	1.4	0.9	1.3	4.9	5.0	2.2	1.3	0.8	0.95
4	.....	1.0	1.4	0.9	1.2	4.3	4.8	2.2	1.4	1.0	1.0
5	.....	1.0	1.0	1.0	1.2	4.3	4.7	2.3	1.5	1.0	1.0
6	.....	1.0	1.0	1.0	1.2	5.3	4.7	2.4	1.4	1.1	1.0
7	.....	1.0	1.0	1.2	1.6	5.8	4.7	2.3	1.45	1.2	0.8
8	.....	1.0	1.0	1.0	2.0	6.0	4.8	2.2	1.5	1.2	0.9
9	.....	1.0	1.0	0.9	2.0	6.5	5.0	2.0	1.5	1.2	0.9
10	0.7	1.0	1.0	1.0	2.3	7.0	4.7	1.95	1.5	1.25	1.1
11	1.0	1.0	1.0	1.0	2.5	5.6	4.3	1.95	1.4	1.3	1.2
12	1.0	1.0	1.0	1.0	2.3	5.7	3.7	2.0	1.2	1.3	1.3
13	1.0	1.0	1.1	1.0	2.0	6.0	3.5	1.95	1.0	1.2	1.5
14	1.0	1.0	1.1	1.0	2.0	7.5	3.5	2.0	1.1	1.2	1.2
15	1.0	1.0	1.2	1.0	1.8	8.4	3.5	2.0	0.9	1.3	1.1
16	1.0	1.0	1.2	0.9	1.4	9.0	3.5	1.95	1.0	1.3	1.1
17	1.0	1.0	1.0	0.9	2.2	9.9	3.6	2.2	1.0	1.3	1.1
18	1.0	1.0	1.0	0.9	2.8	10.8	3.8	2.25	1.0	1.2	1.1
19	1.0	1.0	1.0	0.7	2.7	11.5	3.8	2.3	0.9	1.1	.....
20	1.0	1.0	1.0	0.8	2.6	11.0	3.9	2.0	0.9	1.1	.....
21	1.0	1.0	1.2	0.8	2.4	10.5	3.8	1.95	0.9	0.9	.....
22	0.9	1.8	1.2	1.0	2.0	10.2	3.7	1.9	0.95	0.8	.....
23	0.9	1.8	1.3	0.9	2.3	10.1	3.5	1.9	0.8	1.0	.....
24	0.9	1.0	1.3	1.1	2.0	9.8	3.4	1.8	0.8	1.0	.....
25	0.9	1.0	1.3	1.0	2.3	9.0	3.3	1.7	0.8	1.0	.....
26	0.9	1.0	1.2	1.0	2.6	6.6	3.2	1.6	0.75	1.0	.....
27	0.9	1.0	1.2	0.9	2.7	5.9	3.1	1.6	0.75	1.0	.....
28	0.9	1.0	1.0	1.0	2.8	5.8	3.0	1.55	0.7	1.1	.....
29	0.9	.....	1.1	1.1	2.8	5.6	2.9	1.5	0.7	1.05	.....
30	0.9	.....	1.1	1.1	2.8	5.3	2.6	1.3	0.7	0.95	.....
31	1.0	.....	1.1	.....	2.7	.....	2.4	1.2	.....	9.95	.....

NOTE.—Gage heights Jan., Feb., Mar. and Apr. 7 distorted by ice.

Daily discharge, in second-feet, of Bighorn River at Thermopolis, Wyo., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	660	970	2,590	6,770	1,960	810	485	625
2	660	890	2,910	7,280	2,270	890	485	625
3	590	890	6,430	6,600	1,960	890	520	625
4	590	810	5,410	6,260	1,960	970	660	660
5	660	810	5,410	6,090	2,110	1,060	660	660
6	660	810	7,110	6,090	2,270	970	730	660
7	660	1,160	7,960	6,090	2,110	1,020	810	520
8	660	1,660	8,300	6,260	1,960	1,060	810	590
9	590	1,660	9,150	6,600	1,660	1,060	810	590
10	660	2,110	10,000	6,090	1,590	1,060	850	730
11	660	2,430	9,320	5,410	1,590	970	890	810
12	660	2,110	7,790	4,390	1,660	810	890	890
13	660	1,660	8,300	4,050	1,590	660	810	1,060
14	660	1,660	10,800	4,050	1,660	730	810	810
15	660	1,390	12,400	4,050	1,660	590	890	730
16	590	970	13,500	4,050	1,590	660	890	730
17	590	1,960	15,100	4,220	1,960	660	890	730
18	590	2,910	16,700	4,560	2,040	660	810	730
19	450	2,750	18,000	4,560	2,110	590	730	720
20	520	2,590	17,100	4,730	1,660	590	730	710
21	520	2,270	16,200	4,560	1,590	590	590	700
22	660	1,660	15,700	4,390	1,520	625	520	690
23	590	2,110	15,500	4,050	1,520	520	660	680
24	730	1,660	14,900	3,880	1,390	520	660	660
25	660	2,110	13,500	3,710	1,270	520	660	640
26	660	2,590	9,320	3,550	1,160	485	660	620
27	590	2,750	8,130	3,390	1,160	485	660	580
28	660	2,910	7,960	3,230	1,110	450	730	570
29	730	2,910	7,620	3,070	1,060	450	695	560
30	730	2,910	7,110	2,590	890	450	625	550
31	.....	2,750	.....	2,270	810	.....	625	.....

NOTE.—Daily discharge determined from a rating curve fairly well defined between 650 and 17,000 second-feet. Discharge estimated Apr. 7 and Nov. 19 to 30.

Monthly discharge of Bighorn River at Thermopolis, Wyo., for 1911.

[Drainage area, 8,180 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	a 500	0.061	0.07	30,700	D.
February	.....	.....	a 500	.061	.06	27,800	D.
March	.....	.....	a 600	.073	.08	36,900	D.
April	810	450	637	.078	.09	37,900	B.
May	2,910	810	1,900	.232	.27	117,000	B.
June	18,000	2,590	10,300	1.26	1.41	613,000	C.
July	7,280	2,270	4,740	.579	.67	291,000	B.
August	2,270	810	1,640	.200	.23	101,000	B.
September	1,060	450	727	.089	.10	43,300	B.
October	890	485	718	.088	.10	44,100	B.
November	1,060	520	678	.083	.09	40,300	B.
December	.....	.....	a 550	.067	.08	33,800	D.
The year	18,000	.....	1,970	.240	3.25	1,420,000	

a Estimated.

BIGHORN RIVER NEAR HARDIN, MONT.

Location.—In the SW. ¼, sec. 13, T. 1 S., R. 33 E., at the bridge of the Burlington & Missouri River Railroad, about half a mile above the junction of Bighorn and Little Bighorn rivers, 2 miles from Hardin, Mont.

Records available.—June 16, 1904, to December 31, 1911.

Drainage area.—20,700 square miles.

Gage.—A chain attached to west span of railroad bridge; datum unchanged since August 10, 1905.

Channel.—Composed of gravel; free from vegetation.

Discharge measurements.—Made from railroad bridge.

Winter flow.—Affected by ice.

Diversions.—Water is diverted a few miles above the station by a private irrigation company to irrigate land on the west side of the river.

Discharge measurements of Bighorn River near Hardin, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 16	W. A. Lamb	3.73	3,630
July 26	B. E. Jones	4.77	7,870
Sept. 4	W. A. Lamb	3.70	3,970

Daily gage height, in feet, of Bighorn River near Hardin, Mont., for 1911.

[H. R. Kean, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.9	3.0	4.3	5.8	4.3	3.65	2.95	2.6
2	.....	2.85	3.15	4.6	5.8	4.3	3.6	2.95	2.6
3	.....	3.0	3.1	4.6	5.7	4.3	3.6	2.95	2.7
4	.....	3.0	3.0	4.7	5.6	4.3	3.6	3.0	2.8
5	.....	3.0	3.0	4.8	5.5	4.2	3.55	3.0	2.8
6	.....	2.9	2.95	5.2	5.2	4.3	3.55	3.0	2.8
7	.....	2.85	3.0	5.5	5.1	4.4	3.5	3.0	2.7
8	.....	2.9	3.0	5.3	5.1	4.4	3.5	3.0	2.6
9	.....	2.9	3.2	5.6	5.1	4.3	3.5	3.0	2.5
10	.....	3.0	3.3	5.6	5.2	4.2	3.45	3.0	2.55
11	.....	3.0	3.65	5.7	5.2	4.1	3.6	3.0	2.0
12	.....	2.95	3.7	5.7	5.3	4.1	3.5	3.0	2.0
13	.....	3.0	3.7	5.8	5.2	4.0	3.5	3.0	2.3
14	.....	3.0	3.7	5.8	4.9	4.1	3.4	3.0	2.3
15	.....	3.0	3.65	6.7	4.8	4.0	3.4	2.8	2.5
16	.....	2.8	3.85	6.7	4.6	4.0	3.3	2.7	2.7
17	3.9	2.7	4.3	7.3	4.6	3.9	3.3	2.7	2.9
18	3.9	2.7	4.2	7.3	4.6	3.9	3.2	2.7	3.1
19	3.15	2.6	4.2	7.3	4.8	3.95	3.2	2.7	3.1
20	3.0	2.6	4.1	7.5	4.7	3.85	3.15	2.7	3.0
21	2.9	2.8	4.1	7.7	4.8	3.9	3.2	2.7	3.4
22	3.1	2.9	4.0	7.6	4.9	3.85	3.1	2.6	3.1
23	3.05	2.9	3.8	7.6	4.9	3.85	3.0	2.6	3.0
24	3.1	2.9	3.8	7.2	4.8	3.85	3.0	2.6	3.0
25	3.1	3.0	3.8	6.9	4.6	3.75	3.0	2.6	2.95
26	3.1	3.0	3.8	6.8	4.6	3.8	2.9	2.6	2.9
27	3.05	3.0	3.1	6.7	4.6	3.8	2.9	2.6	2.9
28	2.95	3.0	4.5	6.6	4.4	3.8	2.9	2.6	2.85
29	2.95	3.0	4.3	6.2	4.4	3.7	2.9	2.6	2.85
30	2.95	2.8	4.2	5.9	4.4	3.7	2.8	2.6	2.8
31	2.95	.....	4.2	.....	4.6	3.65	.....	2.6	.....

Daily discharge, in second-feet, of Bighorn River near Hardin, Mont., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1,820	1,990	5,380	12,200	5,860	3,870	2,150	1,560
2	.....	1,740	2,270	6,400	12,200	5,860	3,730	2,150	1,560
3	.....	1,990	2,170	6,400	11,700	5,860	3,730	2,150	1,710
4	.....	1,990	1,990	6,760	11,300	5,860	3,730	2,250	1,880
5	.....	1,990	1,990	7,130	10,800	5,520	3,590	2,250	1,880
6	.....	1,820	1,900	8,710	9,460	5,860	3,590	2,250	1,880
7	.....	1,740	1,990	10,000	9,020	6,220	3,450	2,250	1,710
8	.....	1,820	1,990	9,130	9,020	6,220	3,450	2,250	1,560
9	.....	1,820	2,370	10,400	9,020	5,860	3,450	2,250	1,420
10	.....	1,990	2,590	10,400	9,460	5,520	3,320	2,250	1,490
11	.....	1,990	3,480	10,900	9,460	5,200	3,730	2,250	870
12	.....	1,900	3,610	10,900	9,900	5,200	3,450	2,250	870
13	.....	1,990	3,610	11,300	9,460	4,900	3,450	2,250	.....
14	.....	1,990	3,610	11,300	8,180	5,200	3,180	2,250	.....
15	.....	1,990	3,480	16,000	7,780	4,900	3,180	1,880	.....
16	.....	1,660	4,020	16,000	6,980	4,900	2,920	1,710	.....
17	.....	1,510	5,380	19,400	6,980	4,600	2,920	1,710	.....
18	.....	1,510	5,060	19,400	6,980	4,600	2,680	1,710	.....
19	.....	1,370	5,060	19,400	7,780	4,750	2,680	1,710	.....
20	.....	1,370	4,750	20,600	7,380	4,450	2,570	1,710	.....
21	1,820	1,660	4,750	21,800	7,780	4,600	2,680	1,710	.....
22	2,170	1,820	4,450	22,400	8,180	4,450	2,460	1,560	.....
23	2,080	1,820	3,880	22,400	8,180	4,450	2,250	1,560	.....
24	2,170	1,820	3,880	19,900	7,780	4,450	2,250	1,560	.....
25	2,170	1,990	3,880	18,100	6,980	4,160	2,250	1,560	.....
26	2,170	1,990	3,880	17,500	6,980	4,300	2,060	1,560	.....
27	2,080	1,990	2,170	17,000	6,980	4,300	2,060	1,560	.....
28	1,900	1,990	6,050	16,400	6,220	4,300	2,060	1,560	.....
29	1,900	1,990	5,380	14,200	6,220	4,010	2,060	1,560	.....
30	1,900	1,660	5,060	12,700	6,220	4,010	1,880	1,560	.....
31	1,900	.....	5,060	.....	6,980	3,870	.....	1,560	.....

NOTE.—Daily discharge determined from two well-defined rating curves, applicable Mar. 21 to June 21 and June 22 to Nov. 12, respectively.

Monthly discharge of Bighorn River near Hardin, Mont., for 1911.

[Drainage area, 20,700 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	1,000	0.048	0.06	61,500	D.
February	.....	.....	1,200	.058	.06	66,600	D.
March	2,170	.....	1,690	.082	.09	104,000	C.
April	1,990	1,370	1,820	.088	.10	108,000	B.
May	6,050	1,900	3,600	.174	.20	221,000	B.
June	22,400	5,380	13,900	.672	.75	827,000	B.
July	12,200	6,220	8,500	.411	.47	523,000	B.
August	6,220	3,870	4,980	.241	.28	306,000	B.
September	3,870	1,880	2,960	.143	.16	176,000	B.
October	2,250	1,560	1,900	.092	.11	117,000	B.
November	1,880	870	1,210	.058	.06	72,000	C.
December	.....	.....	1,000	.048	.06	61,500	D.
The year	22,400	.....	3,660	.177	2.40	2,640,000	

NOTE.—Means for January, February, and December, estimated; mean for period Mar. 1 to 20 estimated at 1,500 second-feet; mean for period Nov. 13 to 30 estimated at 1,000 second-feet.

WARM SPRINGS CREEK NEAR DUBOIS, WYO.

Location.—In sec. 32, T. 42 N., R. 107 W., 150 feet above Wind River, about 6 miles above Dubois. The nearest tributary is a small stream entering from the south half a mile above.

Records available.—Fragmentary gage heights May 9 to December 31, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Data too meager to determine.

Discharge measurements.—Made from footbridge at the station.

Winter flow.—Springs keep the creek open during the winter months.

Diversions.—There were adjudicated decrees for diversion of 0.6 second-foot from Warm Springs Creek prior to July 1, 1912.

Accuracy.—Owing to insufficient data it is not possible to make estimates of discharge.

Cooperation.—Station is maintained in cooperation with the United States Forest Service.

Discharge measurements of Warm Springs Creek near Dubois, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 9	O. M. Wimmer	0.40	72.5
Nov. 5	H. B. Waha	.20	48.5

Daily gage height, in feet, of Warm Springs Creek near Dubois, Wyo., for 1911.

[K. S. Clark, observer.]

Day.	May.	June.	Sept.	Oct.	Nov.	Dec.	Day.	May.	June.	Sept.	Oct.	Nov.	Dec.
1			0.20				16		3.10			0.20	0.20
2					0.15	0.20	17						
3							18						
4		2.70					19						
5					.20		20						.19
6							21						
7			.15				22	0.60					
8						.20	23	.90					
9	0.40				.20		24						
10	.30						25						
11							26				0.22		.19
12							27						
13							28	.80		0.25			
14					.21		29					.20	
15							30						
							31						

HORSE CREEK AT DUBOIS, WYO.

Location.—At Dubois, in sec. 7, T. 41 N., R. 106 W., 100 yards above the mouth and 1½ miles below the entrance of Piney Creek.

Records available.—August 4, 1910, to November 13, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Data too meager to determine.

Discharge measurements.—Made from bridge at the station during high water and by wading at ordinary stages.

Winter flow.—Ice causes backwater during the winter months and records are discontinued.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions of 14 second-feet from Horse Creek above the station.

Accuracy.—Owing to lack of high water measurements no estimates of discharge have been made.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of Horse Creek at Dubois, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 7	O. M. Wimmer	9.40	59.8
9	do	9.70	102
Nov. 5	H. B. Waha	9.10	33.0

Daily gage height, in feet, of Horse Creek at Dubois, Wyo., for 1910.

[Earl French, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	9.0	8.75	8.95	9.45	16	9.0	8.8	9.0	8.85	9.55
2	.....	9.0	8.8	8.95	9.5	17	9.05	8.8	9.0	8.85	9.9
3	.....	9.0	8.8	8.95	9.55	18	9.0	8.85	9.0	8.85	9.8
4	9.2	9.0	8.8	8.9	9.5	19	9.0	8.85	8.95	8.85	9.85
5	9.2	9.0	8.8	9.05	9.45	20	9.0	8.8	8.95	9.0	10.25
6	9.15	9.0	8.8	9.0	9.5	21	9.0	8.85	8.95	9.2	9.6
7	9.15	8.85	8.75	9.0	9.7	22	9.0	9.0	8.95	9.1	9.4
8	9.15	8.85	8.9	9.0	9.9	23	9.0	8.9	8.95	9.0	10.1
9	9.1	9.0	8.9	9.0	9.8	24	9.0	8.85	8.95	9.0	10.45
10	9.1	9.0	8.9	8.95	9.7	25	8.9	8.8	8.95	8.95	10.3
11	9.1	9.0	8.9	8.95	9.6	26	8.95	8.8	8.95	9.0	10.5
12	9.1	9.0	8.9	8.95	9.5	27	9.0	8.8	8.95	9.2	10.6
13	9.15	8.85	9.0	8.85	9.55	28	9.0	8.8	8.9	9.5	11.0
14	9.1	8.8	9.0	8.85	9.5	29	9.0	8.75	8.9	9.6	.....
15	9.05	8.8	9.0	8.8	9.55	30	9.0	8.75	8.8	9.6	.....
						31	9.0	.....	8.8	9.45	.....

NOTE.—Gage height distorted by ice after Nov. 25, 1910.

Daily gage height, in feet, of Horse Creek at Dubois, Wyo., for 1911.

[Earl French, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	10.30	10.75	9.62	9.05	9.08	8.98
2	.....	10.25	10.80	9.58	9.05	9.15	8.98
3	.....	10.15	10.60	9.48	9.05	9.10	9.05
4	.....	10.35	10.55	9.50	9.05	9.10	9.10
5	.....	10.45	10.75	9.45	9.10	9.10	9.10
6	.....	10.50	10.75	9.38	9.20	9.10	9.00
7	9.40	10.55	10.75	9.38	9.15	9.10	9.15
8	.....	10.80	10.70	9.38	9.15	9.08	9.28
9	9.60	10.85	10.35	9.40	9.15	9.05	9.22
10	9.50	10.50	10.25	9.38	9.15	9.05	9.20
11	9.35	10.50	10.20	9.38	9.15	9.05	9.12
12	9.45	10.30	10.25	9.35	9.18	9.05	9.18
13	9.62	11.10	10.18	9.35	9.18	9.05	9.18
14	9.65	10.45	10.18	9.38	9.12	9.05	.....
15	10.15	10.65	10.15	9.32	9.10	9.05	.....
16	9.85	11.85	10.15	9.32	9.10	9.02	.....
17	9.68	11.75	10.12	9.28	9.10	9.00	.....
18	9.65	12.30	10.20	9.28	9.10	9.00	.....
19	9.55	11.95	10.18	9.28	9.08	8.98	.....
20	9.50	11.85	10.00	9.25	9.05	8.95	.....
21	9.40	11.70	9.95	9.22	9.05	8.98	.....
22	9.52	11.60	9.90	9.20	9.05	8.95	.....
23	9.58	11.40	9.88	9.18	9.05	8.90	.....
24	9.72	11.35	9.82	9.15	9.05	8.92	.....
25	9.75	10.95	9.80	9.18	9.05	8.90	.....
26	9.82	10.90	9.85	9.12	9.05	8.92	.....
27	9.75	10.80	9.82	9.15	9.05	8.92	.....
28	9.65	10.75	9.72	9.10	9.05	8.88	.....
29	9.72	10.75	9.68	9.08	9.05	8.90	.....
30	9.75	10.75	9.68	9.05	9.05	8.92	.....
31	9.82	.....	9.68	9.05	.....	8.95	.....

LITTLE WIND RIVER ABOVE ARAPAHOE, WYO.

Location.—At railroad bridge in sec. 23, T. 1 S., R. 3 E., opposite the Indian subagency, one-fourth mile above Arapahoe, and one-fourth mile above the mouth of Popo Agie River.

Records available.—May 14 to November 11, 1911. From May 11, 1906, to December 17, 1909, a station was maintained a short distance above the present site. The flow at the two points is comparable.

Drainage area.—Not measured.

Gage.—Chain gage reading approximately 1.6 feet higher than the gage at the former site.

Channel.—Somewhat shifting after high water.

Discharge measurements.—Made from railroad bridge.

Winter flow.—Ice causes backwater during the winter months and records are discontinued.

Diversions.—There were adjudicated decrees for 4.3 second-feet from Little Wind River above the station prior to July 1, 1912.

Accuracy.—Conditions are favorable for accurate results and the estimates should be excellent.

Cooperation.—Station is maintained in cooperation with the State engineer.

Discharge measurements of Little Wind River above Arapahoe, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 14	Fletcher and Kingdon.	3.00	251	June 16	E. O. Christiansen	5.75	2,740
June 6	E. O. Christiansen	4.45	1,260	30	R. H. Fletcher	4.50	1,300
9	do	4.80	1,680	July 19	do	3.85	798
13	do	5.00	1,920	Oct. 15	G. H. Russell	2.30	74.3

Daily gage height, in feet, of Little Wind River above Arapahoe, Wyo., for 1911.

[J. E. Plummer, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.40	4.70	3.05	1.98	2.35	2.15	16	3.32	5.80	3.80	2.45	1.92	2.30	.....
2	.....	3.65	4.65	2.98	1.95	2.32	2.12	17	3.00	6.50	3.80	2.40	1.92	2.30	.....
3	.....	3.70	4.50	2.92	1.90	2.50	2.08	18	2.95	6.10	3.80	2.40	1.90	2.32	.....
4	.....	3.90	4.35	2.88	1.95	2.52	2.20	19	2.90	5.80	3.90	2.38	1.90	2.30	.....
5	.....	4.20	4.40	2.80	2.00	2.50	2.20	20	2.80	5.70	3.90	2.35	1.90	2.25	.....
6	.....	4.40	4.45	2.85	2.00	2.55	2.20	21	2.68	5.70	3.80	2.30	1.90	2.22	.....
7	.....	4.45	4.45	2.78	2.02	2.52	2.15	22	2.65	5.80	3.60	2.30	1.85	2.20	.....
8	.....	4.70	4.40	2.75	2.08	2.55	2.20	23	2.82	5.70	3.60	2.35	1.80	2.30	.....
9	.....	4.80	4.40	2.65	2.05	2.42	2.05	24	3.05	5.40	3.60	2.32	1.80	2.30	.....
10	.....	4.50	4.15	2.60	2.02	2.40	2.30	25	3.15	5.20	3.50	2.32	1.75	2.30	.....
11	.....	4.20	3.90	2.55	2.00	2.35	2.15	26	3.20	4.90	3.48	2.30	1.75	2.25	.....
12	.....	4.60	3.80	2.60	1.95	2.40	.....	27	3.30	4.60	3.40	2.28	1.78	2.20	.....
13	.....	4.90	3.70	2.55	1.90	2.32	.....	28	3.20	4.60	3.38	2.25	1.90	2.15	.....
14	3.00	5.20	3.70	2.48	1.90	2.32	.....	29	3.12	4.60	3.30	2.20	2.12	2.12	.....
15	3.05	5.30	3.70	2.40	1.90	2.25	.....	30	3.08	4.50	3.20	2.15	2.28	2.15	.....
								31	3.15	.....	3.12	2.02	.....	2.25	.....

Daily discharge, in second-feet, of Little Wind River above Arapahoe, Wyo., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	470	1,540	285	33	85	56
2	.....	628	1,480	258	31	80	52
3	.....	660	1,330	237	27	116	48
4	.....	805	1,200	224	31	121	62
5	.....	1,050	1,240	198	35	116	62
6	.....	1,240	1,280	214	35	128	62
7	.....	1,280	1,280	192	37	121	56
8	.....	1,540	1,240	183	43	128	62
9	.....	1,640	1,240	154	40	103	40
10	.....	1,330	1,010	141	37	94	76
11	.....	1,050	805	128	35	85	56
12	.....	1,430	730	141	31	94	.....
13	.....	1,750	660	128	27	80	.....
14	265	2,090	660	112	27	80	.....
15	285	2,210	660	94	27	69	.....
16	422	2,830	730	105	29	76	.....
17	265	3,730	730	94	29	76	.....
18	248	3,210	730	94	27	80	.....
19	230	2,830	805	90	27	76	.....
20	198	2,700	805	85	27	69	.....
21	163	2,700	730	76	27	65	.....
22	155	2,830	595	76	24	62	.....
23	204	2,700	595	85	20	76	.....
24	285	2,330	595	80	20	76	.....
25	330	2,090	530	80	18	76	.....
26	355	1,750	518	76	18	69	.....
27	410	1,430	470	73	19	62	.....
28	355	1,430	458	69	27	56	.....
29	315	1,430	410	62	52	52	.....
30	298	1,330	355	56	73	56	.....
31	330	.....	315	37	.....	69	.....

NOTE.—Daily discharge determined from a well-defined rating curve.

Monthly discharge of Little Wind River above Arapahoe, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May 14-31	422	155	284	11,300	A.
June	3,730	470	1,820	108,000	A.
July	1,540	315	830	51,0	A.
August	285	37	127	7,810	A.
September	73	18	31.1	1,850	A.
October	128	52	83.7	5,150	A.
November 1-11	76	40	57.5	1,250	A.
The period	.....	.....	.....	186,000	

LITTLE WIND RIVER BELOW ARAPAHOE, WYO.

Location.—At highway bridge in sec. 23, T. 1 S., R. 3 E., one-half mile below Arapahoe. Popo Agie River enters 200 yards above. Little Wind River enters Wind River 6 miles below, and between the station and mouth Beaver Creek enters.

Records available.—May 11, 1906, to November 27, 1909; May 14 to November 11, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff; datum unchanged since it was originally placed in 1906. From June 19 to July 19, 1911, a temporary gage was used whose datum was 2.95 feet higher. This was replaced on the latter date by a gage reading to the original datum. All readings are referred to the original datum.

Channel.—Slightly shifting.

Discharge measurements.—Made from highway bridge.

Winter flow.—The river is frozen over during the winter months and the records are discontinued.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions of 4.3 second-feet from Little Wind River and diversions of 563 second-feet from the Popo Agie and tributaries.

Accuracy.—Although there is a slight shift, frequent measurements have defined this, and the estimates should be reliable.

Cooperation.—Station maintained in cooperation with the State engineer.

Discharge measurements of Little Wind River below Arapahoe, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 14	Fletcher and Kingdon	2.90	1,050	June 14	E. O. Christiansen	6.62	4,940
June 6	E. O. Christiansen	5.25	3,090	16	do	7.57	6,980
8	do	5.87	3,840	Oct. 15	G. H. Russell	1.48	231

Daily gage height, in feet, of Little Wind River below Arapahoe, Wyo., for 1911.

[J. E. Plummer, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.6	4.7	2.00	0.78	1.38	1.25	16	3.2	7.6	3.2	1.38	0.85	1.42	.....
2	.....	4.1	4.5	1.92	.75	1.48	1.25	17	2.95	.....	3.3	1.32	.85	1.48	.....
3	.....	4.2	4.4	1.88	.75	1.72	1.12	18	2.9	.....	3.2	1.28	.80	1.52	.....
4	.....	4.5	4.3	1.78	.80	1.70	1.28	19	2.7	6.5	3.6	1.25	.80	1.40	.....
5	.....	5.1	4.2	1.70	.85	1.65	1.28	20	2.5	6.5	3.4	1.18	.80	1.38	.....
6	.....	5.2	4.4	1.78	.92	1.70	1.28	21	2.3	6.8	3.2	1.12	.78	1.38	.....
7	.....	5.4	4.2	1.78	1.05	1.68	1.22	22	2.2	7.0	3.1	1.15	.75	1.35	.....
8	.....	5.7	4.2	1.70	1.10	1.70	1.28	23	2.4	6.5	3.0	1.15	.75	1.42	.....
9	.....	5.8	4.1	1.62	1.08	1.60	1.35	24	2.9	6.0	2.9	1.10	.72	1.42	.....
10	.....	5.4	3.8	1.50	1.00	1.50	1.35	25	2.9	5.5	2.8	1.10	.70	1.40	.....
11	.....	4.8	3.4	1.50	1.00	1.52	1.20	26	3.2	5.0	2.7	1.10	.70	1.40	.....
12	.....	5.5	3.2	1.55	.90	1.52	.....	27	3.2	4.6	2.6	1.10	.72	1.38	.....
13	.....	6.1	3.2	1.50	.88	1.50	.....	28	2.95	4.6	2.5	1.10	.90	1.32	.....
14	2.9	6.3	3.0	1.40	.85	1.50	.....	29	2.8	4.5	2.4	1.02	1.15	1.25	.....
15	3.0	6.6	3.1	1.38	.88	1.42	.....	30	2.8	4.4	2.2	.95	1.32	1.25	.....
								31	2.95	.....	2.1	.88	.....	1.32	.....

Daily discharge, in second-feet, of Little Wind River below Arapahoe, Wyo., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1,560	2,530	485	62	223	180
2	.....	1,990	2,350	445	58	258	180
3	.....	2,080	2,260	426	58	354	141
4	.....	2,350	2,170	381	65	345	189
5	.....	2,920	2,080	345	75	325	189
6	.....	3,030	2,260	381	90	345	189
7	.....	3,250	2,080	381	122	337	171
8	.....	3,610	2,080	345	135	345	189
9	.....	3,740	1,990	313	130	305	212
10	.....	3,250	1,720	265	110	265	212
11	.....	2,620	1,400	265	110	273	165
12	.....	3,370	1,250	285	85	273	.....
13	.....	4,140	1,250	265	81	265	.....
14	1,040	4,430	1,110	230	75	265	.....
15	1,110	4,920	1,180	223	81	237	.....
16	1,250	7,060	1,250	223	75	237	.....
17	1,080	9,660	1,320	202	75	258	.....
18	1,040	7,840	1,250	189	65	273	.....
19	900	4,750	1,560	180	65	230	.....
20	770	4,750	1,400	159	65	223	.....
21	650	5,270	1,250	141	62	223	.....
22	595	5,660	1,180	150	58	212	.....
23	710	4,750	1,110	150	58	237	.....
24	1,040	4,000	1,040	135	53	237	.....
25	1,040	3,370	970	135	50	230	.....
26	1,250	2,820	900	135	50	230	.....
27	1,250	2,440	835	135	53	223	.....
28	1,080	2,440	770	135	85	202	.....
29	970	2,350	710	115	150	180	.....
30	970	2,260	595	98	202	180	.....
31	1,080	.....	540	81	.....	202	.....

NOTE.—Daily discharge determined from a fairly well-defined rating curve; discharge estimated June 17 and 18.

Monthly discharge of Little Wind River below Arapahoe, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May 14-31	1,250	595	990	35,300	B.
June	9,660	1,560	3,890	231,000	B.
July	2,530	540	1,430	87,900	B.
August	485	81	239	14,700	B.
September	202	50	83.4	4,960	B.
October	354	180	258	15,900	B.
November 1-11	212	141	183	4,000	B.
The period	.....	.....	.....	394,000	

POPO AGIE RIVER NEAR LANDER, WYO.

Location.—On the Middle Fork, in the Yellowstone National Forest, at the ranger station in sec. 24, T. 32 N., R. 101 W. The nearest tributary enters several miles below.

Records available.—April 1 to November 9, 1911.

Drainage area.—Not measured.

Gage.—Staff gage used until June 17, 1911, when it was washed out by high water. A new staff gage was installed reading 7.86 feet higher than the original gage. All readings have been referred to the latter gage.

Channel.—Apparently permanent.

Discharge measurements.—Made by wading.

Winter flow.—Ice causes backwater during the winter months and the records are discontinued.

Diversions.—Appropriations amounting to 164 second-feet have been adjudicated on this stream prior to July 1, 1912. Very nearly all of this water is diverted below the station.

Accuracy.—Owing to a lack of high-water measurements, no estimates of discharge have been made.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of Popo Agie River near Lander, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 2	O. M. Wimmer	8.96	53.2
3	do	9.06	59.4
12	do	9.66	190
Nov. 2	H. B. Waha	8.70	22.5

Daily gage height, in feet, of Popo Agie River near Lander, Wyo., for 1911.

[Chas. J. Bayer, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	8.55	8.95	10.35			8.80	9.20	8.65
2	8.58	8.95	10.40			8.82	9.15	8.75
3	8.59	8.92	10.45		9.30	8.82	9.30	8.60
4	8.55	9.80	10.70		9.30	8.85	9.00	8.60
5		9.65	10.85	10.20	9.25	8.85	9.25	8.55
6	8.50	9.40	10.80	10.15	9.40	9.05	9.20	8.55
7	8.50	9.45	11.05	10.20	9.35	8.95	9.05	8.55
8	8.48	9.90			9.28	8.90	9.05	8.55
9		9.85			9.28	8.90	9.05	8.50
10	8.50	10.00	10.35		9.25	8.80	9.00	
11	8.52	10.00	10.75	9.80		8.80		
12	8.50	9.85	11.15	9.85	9.25	8.80		
13	8.48	9.80	11.15	9.90	9.20	8.80	8.90	
14	8.46	9.75	11.15	9.80	9.18	8.80	8.95	
15	8.45	9.80	11.30	9.80	9.18	8.78	8.80	
16		10.50	11.45	9.90	9.20	8.80	8.82	
17	8.48	9.85	11.25	9.85			8.82	
18	8.48	9.75	10.70	9.90	9.12	8.65	8.80	
19	8.50	9.45	11.00		9.10	8.65	8.80	
20	8.52		11.00		9.10		8.80	
21	8.52	9.50	11.40	9.70	9.10	8.70	8.78	
22	8.50			9.75	9.10	8.65	8.70	
23		9.75	11.05	9.65	9.08	8.65		
24	8.68	9.80	10.75	9.65	9.05	8.65		
25	8.75	10.05	10.40	9.62			8.70	
26	8.92	10.05	10.30	9.60		8.68	8.68	
27	9.10	9.90	10.25	9.62		8.85	8.70	
28	9.15	9.85	10.40	9.60		9.05	8.72	
29	9.15	9.80	10.30			9.00	8.72	
30		9.85		9.55	8.80	8.95	8.72	
31		10.10		9.50	8.80		8.65	

LITTLE POPO AGIE RIVER AT HUDSON, WYO.

Location.—A short distance below the highway bridge three-eighths of a mile southwest of Hudson. No tributary between the station and the mouth of the river.

Records available.—August 26, 1907, to December 31, 1909; June 19 to November 11, 1911.

Drainage area.—Approximately 360 square miles.

Gage.—Chain gage. The original gage was located at the highway bridge. On June 13, 1908, a chain gage was installed at the present site, at a somewhat different datum, but was set to read the same as the original gage for the stage at which it was installed.

Channel.—Practically permanent.

Discharge measurements.—Made from the highway bridge during high water and by wading during low stages.

Winter flow.—Ice causes backwater during the winter months and the records are discontinued.

Diversions.—Prior to July 1, 1912, adjudicated diversions from Little Popo Agie River above the station amounted to 49 second-feet and from the tributaries 20 second-feet.

Accuracy.—As the station has not been completely rated no estimates of discharge have been made.

Cooperation.—Station maintained in cooperation with the State engineer.

Discharge measurements of Little Popo Agie River at Hudson, Wyo., in 1911.

Date.	Hydrographer.	Gage height	Discharge.
		Feet.	*Sec.-ft.*
June 19	E. O. Christiansen	4.87	500
30	R. H. Fletcher	3.50	263
July 19	do	3.50	276
Oct. 17	G. H. Russell	2.19	36.5

Daily gage height, in feet, of Little Popo Agie River at Hudson, Wyo., for 1911.

[L. D. Ladd, observer.]

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.60	2.05	1.80	2.0	2.27	16	.....	2.50	1.90	1.80	2.10	.....
2	.....	3.30	2.02	1.78	2.08	2.32	17	.....	2.50	1.90	1.80	2.17	.....
3	.....	3.15	2.00	1.75	2.10	2.32	18	.....	2.50	1.90	1.75	2.19	.....
4	.....	3.10	2.00	1.75	2.10	2.32	19	4.87	3.05	1.90	1.78	2.19	.....
5	.....	3.10	1.98	1.85	2.05	2.32	20	4.90	2.80	1.85	1.80	2.17	.....
6	.....	3.10	2.02	1.92	2.15	2.29	21	5.40	2.60	1.85	1.80	2.17	.....
7	.....	3.00	2.05	1.95	2.15	2.25	22	5.70	2.60	1.85	1.80	2.17	.....
8	.....	3.00	2.10	2.00	2.10	2.27	23	4.80	2.50	1.85	1.80	2.32	.....
9	.....	2.90	2.05	2.00	2.15	2.29	24	4.40	2.50	1.85	1.80	2.29	.....
10	.....	2.80	2.00	1.98	2.15	2.45	25	4.10	2.42	1.85	1.80	2.29	.....
11	.....	2.65	2.02	1.85	2.15	2.47	26	3.70	2.32	1.85	1.82	2.29	.....
12	.....	2.60	2.02	1.85	2.12	.....	27	3.60	2.30	1.85	1.90	2.32	.....
13	.....	2.50	2.00	1.80	2.18	.....	28	3.60	2.28	1.85	1.95	2.27	.....
14	.....	2.50	2.00	1.80	2.15	.....	29	3.50	2.22	1.85	2.05	2.27	.....
15	.....	2.50	2.00	1.80	2.15	.....	30	3.50	2.15	1.85	2.00	2.32	.....
							31	.....	2.08	1.85	.....	2.29	.....

OWL CREEK NEAR THERMOPOLIS, WYO.

Location.—At a highway bridge about 5 miles northwest of Thermopolis, Wyo., near the ranch buildings of the observer, C. H. McCumber.

Records available.—July 30, 1910, to December 31, 1911.

Drainage area.—Not measured.

Gage.—A staff fastened to upstream side of bridge.

Channel.—Probably shifting.

Discharge measurements.—Made by wading.

Winter flow.—Affected by ice.

Diversions.—Water is diverted from Owl Creek for irrigation and practically all the low-water flow is appropriated.

Discharge measurements of Owl Creek near Thermopolis, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 23[a]	W. A. Lamb	1.38	1.05
June 23	R. Richards	2.83	160
Aug. 1	B. E. Jones	1.66	5.5
Oct. 28	do	[b]1.67	0.5

[a] Float measurement. [b] Ice conditions.

Daily discharge, in second-feet, of Owl Creek near Thermopolis, Wyo., for 1910.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		10	1.5	4.0	6.5	6.5	16		1.5	2.5	2.5	6.5	
2		2.5	1.5	6.5	6.5	6.5	17		1.5	2.5	2.5	6.5	
3		2.5	1.5	6.5	6.5	6.5	18		.5	2.5	2.5	6.5	
4		1.5	1.5	6.5	6.5	6.5	19		.5	2.5	2.5	6.5	
5		1.5	1.5	6.5	6.5	6.5			.5	2.5	2.5	6.5	
							20						
6		1.5	2.5	6.5	6.5		21		.5	2.5	2.5	6.5	
7		1.5	2.5	6.5	6.5		22		.5	142	2.5	6.5	
8		1.5	6.5	6.5	6.5		23		.5	76	2.5	6.5	
9		1.5	6.5	4.0	6.5		24		.5	197	2.5	6.5	
10		1.5	6.5	3.2	6.5		25		.5	131	2.5	6.5	
11		1.5	6.5	2.5	6.5		26		.5	10	2.5	6.5	
12		1.5	6.5	2.5	6.5		27		.5	6.5	6.5	6.5	
13		1.5	6.5	2.5	6.5		28		.5	6.5	6.5	6.5	
14		1.5	6.5	2.5	6.5		29		.5	4.0	6.5	6.5	
15		1.5	6.5	2.5	6.5		30	6.5	.5	4.0	6.5	6.5	
							31	34	.5		6.5		

NOTE.—Gage heights after Oct. 26, 1910, distorted by ice.

Daily gage height, in feet, of Owl Creek near Thermopolis, Wyo., for 1911.

[C. H. McCumber, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1		1.7	1.5	1.5	2.0	1.6	1.4	1.5
2		1.7	1.5	1.75	2.0	1.6	1.4	1.5
3		1.7	1.5	2.2	2.0	1.6	1.4	1.6
4		1.5	1.5	2.45	1.9	1.7	1.4	1.6
5		1.5	1.5	2.6	1.9	1.7	1.4	1.6
6		1.5	1.5	2.55	1.8	1.7	1.4	1.6
7		1.5	1.5	2.6	1.9	2.0	1.5	1.6
8		1.5	1.5	2.55	1.7	1.8	1.5	1.6
9		1.5	1.7	2.55	1.7	1.7	1.4	1.5
10		1.5	1.7	2.55	1.8	1.6	1.4	1.5
11		1.5	1.7	2.7	1.7	1.6	1.4	1.5
12	2.0	1.5	1.5	2.8	1.6	1.6	1.4	1.5
13	2.0	1.5	1.5	2.85	1.6	1.6	1.4	1.5
14	2.1	1.5	1.6	2.9	1.6	1.5	1.4	1.5
15	2.1	1.5	1.6	3.0	1.6	1.5	1.4	1.5
16	2.1	1.7	1.6		1.7	1.5	1.4	1.5
17	2.1	1.7	1.5		1.7	1.4	1.4	1.5
18	2.2	1.7	1.5		1.9	1.4	1.4	1.5
19	2.1	1.7	1.5		2.0	1.4	1.4	1.5
20	2.1	1.7	1.5		1.9	1.4	1.4	1.5
21	2.0	1.7	1.5		1.8	1.4	1.4	1.6
22	2.0	1.7	1.4	2.83	1.7	1.4	1.4	1.6
23	2.0	1.5	1.4	2.9	1.7	1.4	1.4	1.6
24	1.9	1.5	1.4	2.85	1.7	1.4	1.4	1.6
25	1.8	1.5	1.4	2.7	1.7	1.4	1.4	1.6
26	1.8	1.5	1.4	2.55	1.6	1.4	1.5	1.6
27	1.8	1.5	1.6	2.4	1.6	1.4	1.5	1.6
28	1.8	1.5	1.5	2.4	1.5	1.4	1.5	1.65
29	1.7	1.5	1.4	2.3	1.5	1.4	1.5	1.65
30	1.7	1.5	1.4	2.1	1.5	1.4	1.5	1.6
31	1.7		1.5		1.5	1.4		1.6

NOTE.—Gage heights, Oct. 21–31, 1911, distorted by ice.

Daily discharge, in second-feet, of Owl Creek near Thermopolis, Wyo., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	6.5	2.5	2.5	24	4.0	1.5	2.5
2	.....	6.5	2.5	8.2	24	4.0	1.5	2.5
3	.....	6.5	2.5	46	24	4.0	1.5	4.0
4	.....	2.5	2.5	84	16	6.5	1.5	4.0
5	.....	2.5	2.5	111	16	6.5	1.5	4.0
6	.....	2.5	2.5	102	10	6.5	1.5	4.0
7	.....	2.5	2.5	111	16	24	2.5	4.0
8	.....	2.5	2.5	102	6.5	10	2.5	4.0
9	.....	2.5	6.5	102	6.5	6.5	1.5	2.5
10	.....	2.5	6.5	102	10	4.0	1.5	2.5
11	.....	2.5	6.5	131	6.5	4.0	1.5	2.5
12	24	2.5	2.5	153	4.0	4.0	1.5	2.5
13	24	2.5	2.5	164	4.0	4.0	1.5	2.5
14	34	2.5	4.0	175	4.0	2.5	1.5	2.5
15	34	2.5	4.0	197	4.0	2.5	1.5	2.5
16	34	6.5	4.0	190	6.5	2.5	1.5	2.5
17	34	6.5	2.5	190	6.5	1.5	1.5	2.5
18	46	6.5	2.5	190	16	1.5	1.5	2.5
19	34	6.5	2.5	190	24	1.5	1.5	2.5
20	34	6.5	2.5	180	16	1.5	1.5	2.5
21	24	6.5	2.5	170	10	1.5	1.5	.....
22	24	6.5	1.5	160	6.5	1.5	1.5	.....
23	24	2.5	1.5	175	6.5	1.5	1.5	.....
24	16	2.5	1.5	164	6.5	1.5	1.5	.....
25	10	2.5	1.5	131	6.5	1.5	1.5	.....
26	10	2.5	1.5	102	4.0	1.5	2.5	.....
27	10	2.5	4.0	76	4.0	1.5	2.5	.....
28	10	2.5	2.5	76	2.5	1.5	2.5	.....
29	6.5	2.5	1.5	60	2.5	1.5	2.5	.....
30	6.5	2.5	1.5	34	2.5	1.5	2.5	.....
31	6.5	.....	2.5	.....	2.5	1.5	.....	.....

NOTE.—Determination of daily discharge for 1910 has been revised by measurements made during 1911. Daily discharge determined from a rating curve fairly well defined between 0 and 10 second-feet. Discharge interpolated June 16 to 21.

Monthly discharge of Owl Creek near Thermopolis, Wyo., for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
August	10	0.5	1.39	855	C.
September	197	1.5	21.9	1.300	C.
October	6.5	2.5	4.10	256	C.
1911.					
March	46	6.5	18.6	1.140	C.
April	6.5	2.5	3.83	228	C.
May	6.5	1.5	2.85	175	C.
June	197	2.5	123	7.320	D.
July	24	2.5	9.63	592	C.
August	24	1.5	3.81	234	C.
September	2.5	1.5	1.73	103	C.
October	4.0	.....	2.44	150	C.
The period	.....	.....	14.7	9.940	

NOTE.—Discharge Oct. 27–31, 1910, estimated at 2.5 second-feet, Mar. 1 to 11, 1911, at 12 second-feet, and Oct. 21–31 at 1.5 second-feet.

NO WOOD RIVER AT BONANZA, WYO.

Location.—In the SW. ¼ SW. ¼ sec. 13, T. 49 N., R. 91 W., near the ranch of J. W. Graves, one-fourth mile north of Bonanza post office.

Records available.—July 29, 1910, to November 30, 1911.

Drainage area.—Not measured.

Gage.—Chain gage on left bank near public highway.

Channel.—Sand and gravel.

Discharge measurements.—Made by wading 50 feet below the gage; in flood, from the public highway bridge one-half mile below.

Winter flow.—Affected by ice.

Diversions.—Irrigation is carried on to some extent and water is diverted both above and below the station.

Discharge measurements of No Wood River at Bonanza, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 20	W. A. Lamb	3.18	473
June 25	R. Richards	3.26	542
Aug. 4	B. E. Jones	2.14	109
Oct. 30	do	2.35	175

Daily gage height, in feet, of No Wood River at Bonanza, Wyo., for 1911.

[Grace E. Taylor, observer.]

Day.	Mar.	Apr.	May.	June.	Aug.	Sept.	Oct.	Nov.
1		2.20	2.45	4.80		1.80	2.28	2.42
2		2.22		5.20		1.80	2.30	2.35
3		2.32		4.60		1.85	2.32	2.35
4		2.32	2.28	4.40	2.15	1.90	2.32	2.35
5		2.40	2.25	4.40	2.35	1.95	2.33	2.38
6		2.41	2.26	4.20	2.28	2.00	2.34	2.41
7		2.31	2.90	4.20	2.40	2.00	2.32	2.38
8			3.20	4.40	2.65	2.00	2.31	2.35
9		2.22	3.70	4.50	2.30	2.00	2.30	2.32
10		2.24	3.60	3.80	2.20	2.00	2.30	2.55
11		2.24	3.30	3.80	2.10	2.00	2.30	2.55
12		2.20	3.20		2.10	2.00	2.30	2.52
13		2.28	3.00	4.40	2.00	2.00	2.28	2.68
14		2.20	3.15		2.00	2.00	2.28	2.80
15			4.00	5.20	2.00	2.00	2.35	2.95
16		1.70	4.90	5.70	1.90	2.00	2.38	2.98
17		2.13	4.20	5.20	1.90	2.05	2.38	3.00
18		2.14			1.90	2.05	2.41	3.00
19	2.26	2.14	3.50		1.85	2.05	2.40	2.98
20	2.36	2.12	3.20		1.80	2.05	2.36	2.95
21	2.35	2.14	3.05		1.80	2.10	2.30	
22	2.44	2.24			1.75	2.10	2.35	
23	2.30				1.80	2.10	2.40	
24	2.22				1.80	2.10	2.35	
25	2.30		3.80	3.26	1.85	2.15	2.38	
26	2.35				1.85	2.20	2.40	
27	2.30		4.00		1.80	2.20	2.35	
28	2.23		3.50		1.80	2.25	2.35	
29	2.20		3.20		1.85	2.20	2.36	
30	2.20	2.55	3.00		1.80	2.25	2.34	
31					1.75		2.35	

NOTE.—Gage heights after Nov. 9 distorted by ice.

Daily discharge, in second-feet, of No Wood River at Bonanza, Wyo., for 1911.

Day.	Mar.	Apr.	May.	June.	Aug.	Sept.	Oct.	Nov.
1	.....	125	198	1,280	100	50	145	187
2	.....	130	180	1,480	100	50	150	165
3	.....	156	162	1,180	100	58	156	165
4	.....	156	145	1,080	112	65	156	165
5	.....	180	138	1,080	105	73	159	174
6	.....	184	140	980	145	80	162	184
7	.....	153	365	980	180	80	156	174
8	.....	142	495	1,080	268	80	153	165
9	.....	130	730	1,130	150	80	150	156
10	.....	135	680	780	125	80	150	.....
11	.....	135	540	780	100	80	150	.....
12	.....	125	495	930	100	80	150	.....
13	.....	145	405	1,080	80	80	145	.....
14	.....	125	472	1,280	80	80	145	.....
15	.....	82	880	1,480	80	80	165	.....
16	.....	40	1,330	1,730	65	80	174	.....
17	.....	108	980	1,480	65	90	174	.....
18	.....	110	805	1,300	65	90	264	.....
19	168	110	630	1,240	58	90	180	.....
20	168	105	495	1,120	50	90	168	.....
21	165	110	428	1,000	50	100	150	.....
22	194	135	516	880	45	100	165	.....
23	180	147	604	760	50	100	180	.....
24	156	159	692	640	50	100	165	.....
25	150	171	780	522	58	112	174	.....
26	165	183	830	.....	58	125	180	.....
27	150	195	880	.....	50	125	165	.....
28	132	207	630	.....	50	138	168	.....
29	125	219	540	.....	58	125	168	.....
30	125	232	680	.....	50	138	162	.....
31	125	.....	980	.....	45	.....	165	.....

NOTE.—Daily discharge determined from a rating curve well defined below 600 second-feet; discharge nterpolated for days for which gage heights are missing.

Monthly dicharge of No Wood River at Bonanza, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March 19–31	194	125	154	3,970	B.
April	232	40	144	8,570	B.
May	1,330	138	575	35,400	C.
June	1,730	.....	994	59,100	C.
August	268	45	88.8	5,460	B.
September	138	50	90.0	5,360	B.
October	264	145	164	10,100	B.
November 1 to 9	.....	.....	171	3,050	B.

NOTE.—Discharge June 26 to 30, estimated at 500 second-feet.

TENSLEEP CREEK NEAR TENSLEEP, WYO.

Location.—In NW. ¼ NW. ¼ sec. 12, T. 47 N., R. 88 W., 5 miles from Tensleep post office and 800 feet east of the county bridge, on Burke's ranch, located by a cliff 80 feet high on north side of creek; just below mouth of Canyon Fork, the principal tributary.

Records available.—September 21, 1910, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Inclined and upright staff.

Channel.—Rocky ledge.

Discharge measurements.—At low and ordinary stages made by wading; at flood stages made from the bridges over Canyon Fork and Tensleep Creek.

Winter flow.—Ice will not form at this station except in extremely cold weather.

Diversions.—A small amount of water is diverted from this stream for irrigation.

Discharge measurements of Tensleep Creek near Tensleep, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 21	W. A. Lamb	0.99	123
June 24[a]	R. Richards	1.20	263
Aug. 4	B. E. Jones	0.38	89
Oct. 31	do	0.00	45

[a] Measurement made from wagon bridges over Ten Sleep and Canyon Fork Creeks.

Daily gage height, in feet, of Tensleep Creek near Tensleep, Wyo., for 19..

[Bessie Burke, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		0.1	0.35	3.05	1.0	0.25	0.0	0.15	0.0	0.05
2		.2	.3	2.75	.9	.25	.0	.15	.0	.05
3		.2	.3	2.2	.85	.25	.0	.15	.0	.05
4		.1	.3	2.3	.75	.35	.0	.2	.0	.0
5		.1	.5	2.7	.65	.4	.05	.2	.0	.05
6		.0	1.05	2.5	.65	.25	.1	.15	.05	.05
7		.0	.95	2.15	.6	.35	.05	.15	.05	.05
8		.0	1.05	2.1	.55	.35	.05	.1	.05	.0
9		0.5	1.0	2.0	.55	.35	.0	.15	.0	.05
10		0.5	1.0	1.7	.5	.3	.0	.15	.0	.05
11	0.05	.0	.95	2.2	.5	.35	.0	.1	.0	.0
12	.0	.0	.9	2.3	.45	.35	.0	.1	.0	.0
13	.0	.0	1.1	2.4	.4	.3	.1	.1	.05	.0
14	.0	.0	1.25	2.8	.3	.35	.1	.15	.05	.0
15	.0	.0	2.25	2.85	.3	.2	.05	.15	.15	.0
16	.0	.0	2.25	2.8	.4	.2	.05	.15	.15	.0
17	.0	.0	1.95	2.45	.45	.1	.1	.15	.1	.0
18	.0	.0	1.65	2.4	.5	.1	.05	.15	.1	.0
19	.0	.0	1.15	2.2	.75	.1	.1	.1	.05	.0
20	.0	.05	1.0	2.15	.4	.05	.05	.05	.1	.0
21	.0	.05	1.0	1.3	.5	.05	.05	.1	.1	.0
22	.0	.1	1.1	1.65	.4	.05	.05	.1	.1	.05
23	.0	.05	1.15	1.4	.3	.05	.05	.1	.05	.0
24	.0	.05	1.6	1.25	.3	.05	.05	.1	.05	.0
25	.0	.1	1.9	1.15	.25	.05	.05	.1	.05	.0
26	.0	.15	2.3	1.0	.25	.0	.05	.05	.05	.0
27	.0	.4	1.6	.9	.25	.05	.05	.05	.05	.0
28	.0	.4	1.3	.8	.25	.05	.1	.05	.05	.0
29	.0	.45	1.15	.75	.3	.0	.05	.05	.0	.0
30	.05	.35	1.75	.65	.3	.05	.05	.0	.05	.0
31	.10	.....	2.1	.....	.25	.0	.....	.0	.....	.05

Daily discharge, in second-feet, of Tensleep Creek near Tensleep, Wyo., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	55	82	940	195	70	45	60	45	50
2	.....	65	76	820	170	70	45	60	45	50
3	.....	65	76	600	169	70	45	60	45	50
4	.....	55	76	640	149	82	45	65	45	45
5	.....	55	101	800	123	88	50	65	45	50
6	.....	45	210	720	123	82	55	60	50	50
7	.....	45	182	580	115	82	50	60	50	50
8	.....	45	210	560	108	82	50	55	50	45
9	.....	50	195	525	108	82	45	60	45	50
10	.....	50	195	420	101	76	45	60	45	50
11	50	45	182	600	101	82	45	55	45	45
12	45	45	170	640	94	82	45	55	45	45
13	45	45	225	680	88	76	55	55	50	45
14	45	45	270	840	76	82	55	60	50	45
15	45	45	620	860	76	65	50	60	60	45
16	45	45	620	840	88	65	50	60	60	45
17	45	45	508	700	94	55	55	60	55	45
18	45	45	402	680	115	55	50	60	55	45
19	45	45	240	600	108	55	55	55	50	45
20	45	50	195	580	88	50	50	50	55	45
21	45	50	195	490	101	50	50	55	55	45
22	45	55	225	402	88	50	50	55	55	50
23	45	50	240	315	76	50	50	55	50	45
24	45	50	385	270	76	50	50	55	50	45
25	45	55	490	240	70	50	50	55	50	45
26	45	60	640	195	70	45	50	50	50	45
27	45	88	385	170	70	50	50	50	50	45
28	45	88	285	149	70	50	55	50	50	45
29	45	94	240	140	76	45	50	50	45	45
30	50	82	438	123	76	50	50	45	50	45
31	55	.....	560	.....	70	45	.....	45	.....	50

NOTE.—Daily discharge determined from a fairly well-defined rating curve. Discharge estimated Mar. 1 to 10, 50 second-feet.

Monthly discharge of Tensleep Creek near Tensleep, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	50	3,070	D.
February	.....	.....	50	2,780	D.
March	55	45	47.3	2,910	C.
April	94	45	55.2	3,280	B.
May	640	76	288	17,700	B.
June	940	123	537	32,000	B.
July	195	70	105	6,460	B.
August	88	45	64.1	3,940	B.
September	55	45	51.3	3,050	B.
October	65	45	56.1	3,450	B.
November	60	45	49.8	2,960	B.
December	50	45	46.6	2,870	B.
The year	940	.....	116	84,500	

NOTE.—Means for January and February estimated.

PAINT ROCK CREEK NEAR HYATTVILLE, WYO.

Location.—In the Bighorn National Forest in the NW. ¼ sec. 18, T. 50 N., R. 88 W., 1½ miles southeast of the Longview ranger station and about 12 miles east of Hyattville; 400 yards below the mouth of the North Fork, the nearest tributary.

Records available.—October 28 to December 31, 1911.

Drainage area.—81 square miles (measured from topographic sheet).

Gage.—Vertical staff.

Channel.—Probably permanent.

Discharge measurements.—Made by wading.

Winter flow.—No data.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions from Paint Rock Creek amounting to 54 second-feet. Practically all the water is diverted below the station.

Accuracy.—Sufficient data to determine accuracy have not been obtained.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

The following discharge measurement was made by H. B. Waha on October 28, 1911: Gage height, 0.80 foot; discharge, 26 second-feet.

The following additional gage heights were observed at this station: November 3, 1.10 feet; December 23, 0.15 foot.

PAINT ROCK CREEK NEAR BONANZA, WYO.

Location.—In the SE. ¼ NE. ¼ sec. 19, T. 49 N., R. 90 W., near the farmhouse of William Paumer, 1½ miles from Bonanza post office and 12 miles from Manderson, Wyo.; about 1½ miles above junction with No Wood River.

Records available.—July 28, 1910, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Chain gage on the right bank of the stream, directly in front of the house of the observer.

Channel.—Bed of stream rocky and clean, probably nonshifting.

Discharge measurements.—Made by wading at the gage at low and ordinary stages, and from the highway bridge, one-fourth mile below, in flood.

Winter flow.—Ice common at gaging station.

Diversions.—Water for irrigation is diverted above the station.

Discharge measurements of Paint Rock Creek near Bonanza, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 20	W. A. Lamb	3.47	173
June 25	R. Richards	3.77	289
Aug. 4	B. E. Jones	2.91	64
Oct. 30	do	2.85	61

Daily gage height, in feet, of Paint Rock Creek near Bonanza, Wyo., for 1911.

[V. Paumer, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.57	2.48	5.45	3.30	2.62	2.24	2.81	2.80
2	.....	2.57	2.48	5.60	3.40	2.63	2.20	2.84	2.80
3	.....	2.61	2.41	4.90	3.20	2.72	2.22	2.90	2.74
4	.....	2.61	2.38	5.00	3.10	2.94	2.22	2.92	2.91
5	.....	2.67	2.29	5.35	3.10	3.00	2.24	2.91	2.91
6	.....	2.67	3.25	4.89	3.10	3.00	2.31	2.94	2.84
7	.....	2.59	3.30	4.75	3.05	3.25	2.32	3.00	2.80
8	.....	2.60	3.90	5.00	3.00	3.10	2.34	2.92	2.80
9	.....	2.59	4.40	4.70	2.91	3.00	2.34	2.92	2.81
10	.....	2.39	4.35	4.40	2.90	2.81	2.34	2.84	.....
11	.....	2.41	3.90	4.30	2.73	2.71	2.41	2.92	.....
12	.....	2.49	3.40	4.90	2.63	2.64	2.42	2.81	.....
13	2.67	2.49	3.40	5.10	2.53	2.52	2.42	2.81	.....
14	2.67	2.47	3.70	5.10	2.51	2.54	2.52	2.73	.....
15	2.61	2.41	4.30	5.10	2.50	2.51	2.52	2.91	.....
16	2.60	2.37	5.10	5.60	2.44	2.44	2.52	2.82	.....
17	2.68	2.37	4.60	5.10	2.52	2.42	2.54	2.82	.....
18	2.59	2.38	4.30	4.50	2.62	2.40	2.61	2.90	.....
19	2.59	2.31	4.05	4.6	2.73	2.41	2.61	2.82	.....
20	2.59	2.31	3.60	4.85	2.80	2.34	2.52	2.84	.....
21	2.60	2.39	3.40	4.50	2.92	2.31	2.52	2.80	.....
22	2.60	2.39	3.45	4.30	2.80	2.31	2.54	2.82	.....
23	2.59	2.31	3.80	4.10	2.74	2.34	2.54	2.80	.....
24	2.59	2.31	3.80	4.00	2.72	2.40	2.60	2.94	.....
25	2.59	2.29	4.30	3.80	2.64	2.32	2.61	2.92	.....
26	2.59	2.27	5.00	3.55	2.62	2.30	2.70	2.92	.....
27	2.58	2.19	4.40	3.45	2.52	2.31	2.71	2.80	.....
28	2.51	2.27	3.90	3.30	2.51	2.34	2.71	2.90	.....
29	2.57	2.28	3.70	3.70	2.42	2.40	2.74	2.82	.....
30	2.51	2.48	4.10	3.20	2.44	2.31	2.81	2.81	.....
31	2.51	.....	4.65	.....	2.51	2.30	.....	2.81	.....

Daily discharge, in second-feet, of Paint Rock Creek near Bonanza, Wyo., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	31	24	890	140	35	11	54	53
2	.....	31	24	950	165	36	10	58	53
3	.....	34	19	670	120	44	11	66	46
4	.....	34	17	710	100	72	11	69	68
5	.....	39	13	850	100	82	11	67	68
6	.....	39	130	630	100	82	14	72	58
7	.....	32	140	612	91	130	14	82	53
8	.....	33	280	710	82	100	15	69	53
9	.....	17	490	595	68	82	15	69	54
10	.....	17	472	490	66	54	15	58	.....
11	.....	19	315	455	45	43	19	69	.....
12	.....	24	165	670	36	37	19	54	.....
13	39	24	165	750	14	27	19	54	.....
14	39	23	250	750	26	28	27	45	.....
15	34	19	455	750	25	26	27	67	.....
16	33	16	750	950	21	21	27	56	.....
17	40	16	560	750	27	19	28	56	.....
18	32	17	455	525	35	18	34	66	.....
19	32	13	368	560	45	19	34	56	.....
20	32	13	220	650	53	15	27	58	.....
21	33	17	165	525	69	14	27	53	.....
22	33	17	178	455	53	14	28	56	.....
23	32	13	280	385	46	15	28	53	.....
24	32	13	280	350	44	18	33	72	.....
25	32	13	455	208	37	14	34	69	.....
26	32	12	710	205	35	13	42	69	.....
27	31	10	490	178	27	14	43	53	.....
28	26	12	315	140	26	15	43	66	.....
29	31	12	250	140	19	18	46	56	.....
30	26	24	385	120	21	14	54	54	.....
31	26	.....	578	.....	26	13	.....	54	.....

NOTE.—Daily discharge determined from a rating curve fairly well defined. Daily discharge Mar. 1 to 12 estimated at 40 second-feet; Nov. 10 to 30, discharge estimated at 50 second-feet.

Monthly discharge of Paint Rock Creek near Bonanza, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January			40	2,460	D.
February			40	2,220	D.
March			35.3	2,170	C.
April	30	10	21.1	1,260	B.
May	750	13	303	18,600	B.
June	950	120	556	33,100	B.
July	165	14	56.8	3,490	B.
August	130	13	36.5	2,240	B.
September	54	10	25.5	1,520	B.
October	82	45	61.3	3,770	B.
November	68		51.9	3,090	C.
December			35	2,150	D.
The year	950		105	76,100	

NOTE.—Means January, February, and December estimated.

GREYBULL RIVER NEAR MEETEETSE, WYO.

Location.—In the NW. ¼ SE. ¼ sec. 15, T. 48 N., R. 101 W., 300 feet from Wilson's house, about 5 miles from Meeteetse, Wyo., on the road to Sunshine & Wilson's mine.

Records available.—September 14, 1910, to December 31, 1910.

Drainage area.—Not measured.

Gage.—Staff gage fastened to south span of the middle pier on the upstream side of the bridge; datum unchanged.

Channel.—Bed of stream rocky.

Discharge measurements.—At flood stage made from the upstream side of the bridge; low-water measurements are made by wading either above or below the bridge.

Diversions.—Irrigation is carried on extensively by water diverted from this stream and its tributaries.

Discharge measurements of Greybull River near Meeteetse, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 26	W. A. Lamb	1.80	382
June 27	R. Richards	2.55	1,070
Aug. 6	B. E. Jones	1.33	366
7	do	1.33	361
Nov. 3	do	0.83	146

Daily gage height, in feet, and discharge, in second-feet, of Greybull River near Meeteetse, Wyo., for 1910.

[Katherine Wilson, observer.]

Day.	September.		October.		November.		December.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	.....	0.98	185	0.98	185	0.85	156
2	.....	.....	1.01	193	.96	180	.85	156
3	.....	.....	1.02	195	.94	176	.83	151
4	.....	.....	.98	185	.86	158	.82	149
5	.....	.....	.97	183	.78	141	.79	143
6	.....	.....	1.06	206	.96	180	.75	135
7	.....	.....	1.03	198	.91	168	.76	138
8	.....	.....	.99	188	.86	158	.82	149
9	.....	.....	.97	183	.79	143	.85	156
10	.....	.....	.97	183	.89	164	.88	162
11	.....	.....	.97	183	.87	160	.85	156
12	.....	.....	.97	183	.84	153	.86	158
13	.....	.....	.96	180	.82	149	.88	162
14	0.68	124	.97	183	.74	134	.90	166
15	.68	124	.97	183	.72	131	.94	176
16	.81	147	.96	180	.70	127	.96	180
17	1.30	280	1.01	193	.78	141	1.04	.....
18	.86	158	.99	188	.85	156	1.65	.....
19	.98	185	.97	183	.88	162	1.78	.....
20	.85	156	.78	141	.69	126	.98	.....
21	.88	162	.89	164	.75	136	.98	.....
22	2.34	889	.86	158	.70	127	3.00	.....
23	1.27	270	.90	166	.88	162	3.00	.....
24	1.06	206	.88	162	.85	156	2.68	.....
25	.98	185	.89	164	.80	145	3.00	.....
26	1.07	209	.99	188	.85	156	.....	.....
27	1.07	209	.92	171	.65	120	.....	.....
28	1.04	201	.98	185	.68	124	.....	.....
29	.98	185	1.02	195	.85	156	.....	.....
30	.98	185	1.00	190	.88	162	.....	.....
31	.....	.....	.96	180	.....	.....	.....	.....

NOTE.—Gage heights Mar. 12 to 14 and after Dec. 16, distorted by ice.

Daily gage height, in feet, of Greybull River near Meeteetse, Wyo., for 1911.

[Katherine Wilson, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.74	0.89	1.55	2.30	1.50	0.94	0.94	0.83	0.84
2	.....	.74	.98	1.65	2.15	1.50	.96	.92	.84	.84
3	.....	.74	.98	1.45	2.20	1.45	.96	.92	.83	.84
4	.....	.76	.96	1.90	2.25	1.45	.95	.90	.86	.84
5	.....	.76	.98	2.85	2.30	1.35	.97	.88	.88	.....
6	.....	.75	1.65	2.90	2.30	1.38	.98	.88	.86	.....
7	.....	.74	1.60	3.05	2.50	1.30	1.00	.88	.83	.....
8	.....	.74	1.60	3.20	2.55	1.35	.98	.86	.82	.....
9	.....	.76	1.95	3.00	2.00	1.35	.97	.86	.82	.....
10	.....	.78	1.55	2.90	1.90	1.30	.96	.87	.82	.....
11	.....	.76	1.55	2.95	1.90	1.30	.95	.86	.82	.....
12	1.25	.72	1.50	3.40	1.85	1.25	.97	.86	.82	.....
13	1.40	.65	1.50	4.85	1.85	1.20	.96	.86	.83	.....
14	1.60	.57	1.60	3.80	1.85	1.20	.96	.86	.86	.....
15	.98	.54	2.65	4.15	1.90	1.20	.96	.87	.86	.....
16	.85	.60	1.95	3.85	1.90	1.20	.95	.87	.86	.....
17	.88	.62	1.70	3.75	2.05	1.15	.97	.87	.86	.....
18	.88	.65	1.45	4.05	2.00	1.10	.96	.87	.88	.....
19	.94	.68	1.30	3.55	1.95	1.00	.96	.84	.90	.....
20	1.00	.71	1.25	3.50	2.80	.98	.95	.84	.94	.....
21	.98	.76	1.20	3.40	2.00	.98	.95	.86	.94	.....
22	.84	.73	1.65	3.20	2.05	.95	.96	.90	.96	.....
23	.85	.78	1.45	2.95	1.95	.95	.96	.88	.96	.....
24	.88	.75	1.90	2.90	1.80	.95	.97	.86	.96	.....
25	.76	.78	1.95	2.75	1.75	.92	.97	.84	.94	.....
26	.75	.81	2.05	2.55	1.70	.90	.96	.83	.94	.....
27	.68	1.00	1.85	2.50	1.70	.92	.95	.83	.88	.....
28	.65	.92	1.65	2.55	1.70	.94	.95	.84	.86	.....
29	.72	.96	1.85	2.50	1.65	.94	.94	.84	.86	.....
30	.72	.96	1.95	2.65	1.55	.92	.94	.83	.84	.....
31	.74	.....	2.05	.....	1.50	.90	.....	.83	.....	.....

Daily discharge, in second-feet, of Greybull River near Meeteetse, Wyo., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	134	164	378	855	355	176	176	151	153
2	.....	134	185	425	732	355	189	171	153	153
3	.....	134	185	336	770	336	180	171	151	153
4	.....	138	180	565	812	336	178	166	158	153
5	.....	138	185	1,340	855	298	183	162	162	.....
6	.....	136	425	1,390	855	309	185	162	158	.....
7	.....	134	400	1,520	1,030	280	190	162	151	.....
8	.....	134	400	1,660	1,080	298	185	158	149	.....
9	.....	138	595	1,480	625	298	183	158	149	.....
10	.....	141	378	1,390	565	286	180	160	149	.....
11	.....	138	378	1,440	565	280	178	158	149	.....
12	.....	131	355	1,840	535	264	183	158	149	.....
13	.....	120	355	3,140	535	247	180	158	151	.....
14	.....	108	400	2,200	535	247	180	158	158	.....
15	185	105	1,160	2,520	565	247	180	160	158	.....
16	156	112	595	2,240	565	247	178	160	158	.....
17	162	115	450	2,160	660	232	183	160	158	.....
18	162	120	336	2,420	625	217	180	160	162	.....
19	176	124	280	1,980	595	190	180	153	166	.....
20	190	129	264	1,930	1,300	185	178	153	176	.....
21	185	138	247	1,840	625	185	178	158	176	.....
22	153	132	425	1,660	660	178	180	166	180	.....
23	156	141	336	1,440	595	178	180	162	180	.....
24	162	136	565	1,390	505	178	183	158	180	.....
25	138	141	595	1,260	472	171	183	153	176	.....
26	136	147	660	1,080	450	166	180	151	176	.....
27	124	190	535	1,030	450	171	178	151	162	.....
28	120	171	425	1,080	450	176	178	153	158	.....
29	131	180	535	1,030	425	176	176	153	158	.....
30	131	180	595	1,160	378	171	176	151	153	.....
31	134	.....	660	.....	355	166	.....	151	.....	.....

NOTE. Daily discharge for 1910 and 1911 determined from a poorly defined rating curve.

Monthly discharge of Greybull River near Meeteetse, Wyo., for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
September 14-30	889	124	228	7,690	C.
October	206	141	181	11,100	C.
November	185	120	151	8,990	C.
December	180	135	158	9,720	D.
1911.					
January	.....	.....	150	9,220	
February	.....	.....	140	7,780	
March	190	120	152	9,350	D.
April	190	105	137	8,150	C.
May	1,160	164	427	26,300	C.
June	3,140	336	1,510	89,800	C.
July	1,300	355	646	39,700	C.
August	355	166	239	14,700	C.
September	190	176	180	10,700	C.
October	176	151	159	9,780	C.
November	180	149	160	9,520	C.
December	.....	.....	140	8,600	
The year	.....	.....	.....	244,000	

NOTE.—Discharge Dec. 17 to 31, 1910, estimated at 160 second-feet. Means for January, February, and December, 1911, estimated. Discharge Mar. 1 to 14, 1911, estimated at 150 second-feet.

WOOD RIVER NEAR MEETEETSE, WYO.

Location.—In the SE. ¼ sec. 22, T. 48 N., R. 101 W., on the highway bridge 800 feet above the junction of Wood and Meeteetse rivers, 9 miles from Meeteetse post office, on the road running west to the Pitchfork ranch.

Records available.—September 15, 1910, to December 31, 1911.

Gage.—Staff fastened to the wind brace on the north side of the bridge.

Channel.—Bed of stream, gravel.

Discharge measurements.—Made from the downstream side of bridge.

Winter flow.—Ice present during winter months.

Diversions.—A few ditches, all above the station, divert water from this stream.

Discharge measurements of Wood River near Meeteetse, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 26	W. A. Lamb	1.05	127
June 27	R. Richards	1.74	323
Aug. 6	B. E. Jones	1.24	148
Nov. 3	do	1.03	86
3	do	1.03	85

Daily gage height, in feet, and discharge, in second-feet, of Wood River near Meeteetse, Wyo., for 1910.

[Guinevere Irwin, observer.]

Day.	September.		October.		November.		December.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			0.80	68	0.75	58	0.72	53
2			.85	79	.75	58	.70	49
3			.82	72	.75	58	.70	49
4			.81	70	.74	57	.70	49
5			.80	68	.74	57	.70	49
6			.81	70	.73	55	.70	49
7			.81	70	.73	55	.70	49
8			.78	64	.73	55	.70	49
9			.75	58	.72	53	.70	49
10			.75	58	.72	53	.70	49
11			.75	58	.73	55		
12			.74	57	.72	53		
13			.74	57	.72	53		
14			.73	55	.71	51		
15	0.78	64	.73	55	.71	51		
16	.82	72	.72	53	.71	51		
17	.85	79	.71	51	.71	51		
18	.84	77	.73	55	.71	51		
19	.84	77	.72	53	.72	53		
20	.85	79	.70	49	.73	55		
21	.84	77	.70	49	.71	51		
22	.95	102	.70	49	.72	53		
23	.90	90	.68	46	.72	53		
24	.85	79	.67	44	.70	49		
25	.85	79	.69	47	.70	49		
26	.84	77	.72	53	.71	51		
27	.80	68	.77	62	.71	51		
28	.78	64	.80	68	.75	58		
29	.80	68	.77	62	.75	58		
30	.78	64	.75	58	.75	58		
31			.77	62				

Daily gage height, in feet, of Wood River near Meeteetse, Wyo., for 1911.

[Guinevere Irwin, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	0.65	0.65	1.09	1.48	1.26	1.00	0.72	1.03
2	.....	.65	.70	1.11	1.48	1.26	1.00	.89	1.04
3	.....	.65	.68	1.09	1.46	1.21	1.00	.84	1.04
4	.....	.60	.70	1.14	1.43	1.22	1.00	.86	1.03
5	.....	.62	.76	1.19	1.48	1.21	1.02	.89	1.03
6	.....	.61	.80	1.24	1.43	1.21	.99	.90	1.01
7	.....	.64	.85	1.23	1.48	1.16	1.00	.89	1.01
8	.....	.66	.85	1.24	1.48	1.16	1.00	.88	1.04
9	.....	.60	.92	1.49	1.38	1.16	.95	.89	.99
10	.....	.61	.86	1.09	1.28	1.16	.99	.88	.99
11	.....	.61	.82	1.29	1.23	1.16	.98	.86	1.01
12	.....	.60	.80	1.34	1.20	1.16	.97	.88	1.39
13	.....	.59	.80	1.49	1.18	1.14	.99	.86	1.39
14	.....	.65	.85	1.44	1.23	1.06	.95	.86	1.41
15	.....	.66	1.10	2.39	1.28	1.06	.95	.85	1.41
16	.....	.65	.90	2.14	1.36	1.06	.97	.84	1.59
17	.....	.60	.90	2.39	1.46	1.04	.95	.85	1.58
18	.....	.60	.82	2.49	1.38	1.01	.95	.86	1.39
19	.....	.60	.80	2.29	1.48	1.01	.90	.85	1.14
20	.....	.58	.80	2.19	1.53	1.01	.95	.86	.89
21	.....	.58	.76	2.09	1.48	.98	.95	.93	.89
22	.....	.58	.78	1.99	1.40	1.01	.87	.88	.94
23	.....	.58	.76	1.89	1.43	1.00	.85	.84	.99
24	.....	.59	.84	1.79	1.41	1.06	.90	.84	1.04
25	.....	.58	.85	1.69	1.38	1.06	.90	.84	1.04
26	0.65	.65	1.05	1.59	1.36	1.06	.90	.81	.....
27	.72	.72	.95	1.59	1.38	1.06	.87	.84	.....
28	.75	.70	.90	1.79	1.28	1.06	.85	.86	.....
29	.65	.70	.90	1.59	1.26	1.06	.85	.89	.....
30	.65	.65	.90	1.59	1.26	1.06	.85	.92	.....
31	.65	.....	.95	.....	1.33	1.06	.....	.96	.....

NOTE.—Gage heights distorted by ice Nov. 12 to 25.

Daily discharge, in second-feet, of Wood River near Meeteetse, Wyo., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	41	41	138	228	153	80	28	88
2	.....	41	49	142	228	153	80	58	90
3	.....	41	46	138	221	138	80	48	90
4	.....	33	49	150	210	141	80	52	88
5	.....	36	60	162	228	138	85	58	88
6	.....	35	68	177	210	138	78	60	82
7	.....	39	79	174	228	123	80	58	82
8	.....	43	79	177	228	123	80	56	90
9	.....	33	95	256	193	123	70	58	78
10	.....	35	81	138	159	123	78	56	78
11	.....	35	72	192	124	123	76	52	82
12	.....	33	68	202	135	123	74	56	.....
13	.....	32	68	256	129	117	78	52	.....
14	.....	41	79	239	144	95	70	52	.....
15	.....	43	140	615	159	95	70	50	.....
16	.....	41	90	506	186	95	74	48	.....
17	.....	33	90	615	221	90	70	50	.....
18	.....	33	72	665	193	82	70	52	.....
19	.....	33	68	570	228	82	60	50	.....
20	.....	30	68	520	246	82	70	52	.....
21	.....	30	60	470	228	76	70	66	.....
22	.....	30	64	426	200	82	54	56	.....
23	.....	30	60	386	210	80	50	48	.....
24	.....	32	77	346	204	95	60	48	.....
25	.....	30	79	306	193	95	60	48	.....
26	41	41	128	266	186	95	60	42	.....
27	53	53	102	266	193	95	54	48	.....
28	58	49	90	346	159	95	50	52	.....
29	41	49	90	266	153	95	50	58	.....
30	41	41	90	266	153	95	50	64	.....
31	41	.....	102	.....	176	95	.....	72	.....

NOTE.—Daily discharge determined from fairly well defined rating curves applicable Sept. 15, 1910, to June 18 1911, and June 19 to Nov. 11, 1911.

Monthly discharge of Wood River near Meeteetse, Wyo., for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
September 15–30	102	64	76	2,410	B.
October	79	44	58.7	3,610	B.
November	58	49	53.8	3,200	B.
December	53	.....	46.4	2,850	C.
1911.					
January	.....	.....	*a* 40	2,460	D.
February	.....	.....	*a* 35	1,940	D.
March	.....	.....	41.1	2,530	D.
April	53	30	37.2	2,210	B.
May	140	41	77.5	4,770	B.
June	665	138	313	18,600	B.
July	246	129	197	12,100	B.
August	153	76	108	6,640	B.
September	85	50	68.7	4,090	B.
October	72	28	53.2	3,270	B.
November	90	78	72.3	4,300	C.
December	.....	.....	*a* 50	3,070	D.
The year	.....	.....	91.1	66,000	

a Estimated.

NOTE.—Discharge Dec. 11 to 31, 1910, estimated at 45 second-feet per day; Mar. 1 to 25, 1911, estimated at 40 second-feet; Nov. 12 to 30, 1911, estimated at 65 second-feet.

LITTLE BIGHORN RIVER NEAR WYOLA, MONT.

Location.—One-fourth mile below proposed headworks of Little Bighorn canal No. 3, in the N. ½ SW. ¼ sec. 28, T. 8 S., R. 35 E., about 16 miles above the mouth of Lodge Grass Creek.

Records available.—September 7 to October 31, 1911.

Gage.—Overhanging chain gage on right bank.

Channel.—Practically permanent; bed of stream is composed of gravel and cobblestones.

Discharge measurements.—Made by wading at ford below the gage.

Winter flow.—Channel filled with ice during the winter months; winter gage heights are not reliable.

Diversion.—None.

The following discharge measurement was made by W. A. Lamb:

September 7, 1911: Gage height, 4.08 feet; discharge, 91 second-feet.

Daily gage height, in feet, of Little Bighorn River near Wyola, Mont., for 1911.

[Charles C. Dillon, observer.]

Day.	Sept.	Oct.	Day.	Sept.	Oct.	Day.	Sept.	Oct.
1	.....	3.95	11	3.96	3.95	21	3.95	3.95
2	.....	3.95	12	3.97	3.95	22	3.95	3.95
3	.....	3.95	13	3.95	3.95	23	3.95	4.01
4	.....	4.00	14	3.96	3.95	24	4.00	4.00
5	.....	4.00	15	3.95	4.00	25	4.00	4.00
6	.....	3.98	16	3.95	4.00	26	3.96	3.98
7	4.08	3.95	17	3.95	3.96	27	3.95	3.98
8	4.01	3.95	18	3.95	3.95	28	3.95	3.95
9	4.01	3.95	19	3.95	3.95	29	3.95	3.95
10	3.96	3.95	20	3.95	3.95	30	3.95	3.95
						31	.....	3.95

LITTLE BIGHORN RIVER NEAR CROW AGENCY, MONT.

Location.—At the Chicago, Burlington & Quincy Railroad bridge 2 miles south of Crow Agency, Mont., in W. ½ sec. 18, T. 3 S., R. 35 E., about 14 miles above the junction with Bighorn River.

Records available.—March 24, 1905, to June 30, 1906; September 7, 1911, to December 31, 1911.

Gage.—Vertical staff attached to downstream end of a pile bridge pier. The records from March 24, 1905, to June 30, 1906, were obtained from a standard chain gage attached to the upstream side of the railroad bridge at Crow Agency, about 2 miles farther downstream. No tributaries enter between these two points.

Channel.—Permanent, broken by the piers of the bridge. Bed of the stream is coarse gravel and cobblestones. Current is sluggish at the gage.

Discharge measurements.—Made from downstream side of the bridge; low-water measurements are made by wading at the ford about 75 feet above the bridge.

Winter flow.—Affected by ice, which forms at the control below the bridge.

Diversion.—None.

Discharge measurements of Little Bighorn River near Crow Agency, Mont., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 5	W. A. Lamb	4.0	61
Nov. 17	do	(a)	100

a Ice.

SHOSHONE RIVER AT CORBETT DAM, WYO.

Location.—In the NE. ¼ sec. 7, T. 53 N., R. 100 W., at the Corbett diversion dam, 8 miles below Cody, Wyo.

Records available.—April 20, 1908, to October 25, 1911.

Drainage area.—Not measured at this station; the drainage area above Cody is 1,400 square miles. Sage Creek, the only important tributary that enters between this station and Cody, drains only about 25 square miles.

Gage.—Forty feet above the crest of the dam; readings represent height of water above crest.

Determinations of discharge.—The discharge is computed by considering the dam as a weir and the sluice tunnel gates as submerged orifices. The dam is of reinforced concrete, of the buttressed type, having on the upstream side a deck 2½ feet thick sloping 1 to 1 and supported by buttresses 2 feet thick spaced 14 feet on centers; it raises the low-water elevation of the river 10.2 feet; the length between abutments is 400 feet.

Cooperation.—Gage heights and gate openings furnished by the United States Reclamation Service.

The following discharge measurement was made by B. E. Jones at the highway bridge at Cody:

August 7, 1911: Gage height, 1.83 feet; discharge, 3,720 second-feet.

Daily gage height, in feet, of Shoshone River at Corbett dam, Wyo., for 1911.

[J. A. Fleming, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	0.35	0.47	0.34	0.56	0.75	1.14	1.90	1.56	1.65	0.98
2	.36	.44	.35	.65	.70	1.17	1.90	1.84	1.64	.99
3	.46	.48	.35	.65	.69	1.21	1.88	1.84	1.61	.99
4	.41	.37	.37	.51	.68	1.20	1.88	1.84	1.60	.99
5	.45	.37	.39	.57	.72	1.32	1.90	1.85	1.58	.96
6	.51	.39	.39	.53	.80	1.37	1.88	1.85	1.56	.94
7	.46	.38	.40	.56	.82	1.20	1.88	1.85	1.55	.93
8	.37	.34	.43	.54	.85	1.29	1.88	1.83	1.56	.90
9	.35	.31	.44	.57	.89	1.36	1.88	1.84	1.55	.88
10	.46	.33	.35	.56	.92	1.38	1.88	1.84	1.53	.87
11	.38	.36	.42	.55	.90	1.40	1.87	1.83	1.50	.83
12	.46	.38	.35	.51	.88	1.40	1.88	1.81	1.46	.79
13	.54	.41	.37	.57	.84	1.43	1.88	1.82	1.44	.70
14	.78	.35	.41	.46	.89	1.46	1.88	1.80	1.43	.54
15	.60	.35	.44	.50	.90	1.53	1.87	1.80	1.43	.54
16	.43	.35	.46	.46	.90	1.59	1.87	1.79	1.43	.53
17	.41	.38	.48	.50	.90	1.63	1.88	1.79	1.41	.48
18	.43	.32	.56	.55	.90	1.67	1.88	1.77	1.33	.49
19	.39	.36	.45	.58	.90	1.70	1.87	1.75	1.30	.47
20	.39	.36	.51	.57	.93	1.73	1.90	1.74	1.28	.40
21	.40	.35	.57	.58	.92	1.75	1.87	1.74	1.27	.37
22	.32	.32	.62	.68	.93	1.78	1.87	1.74	1.20	.32
23	.32	.30	.63	.69	.93	1.80	1.80	1.72	1.09	.35
24	.45	.32	.65	.55	.92	1.80	1.77	1.71	1.05	.35
25	.41	.35	.63	.55	.90	1.80	1.73	1.71	1.04	.35
26	.41	.49	.55	.61	.94	1.84	1.67	1.71	1.04	.....
27	.41	.44	.50	.68	1.08	1.85	1.66	1.69	1.03	.....
28	.40	.36	.47	.72	1.11	1.83	1.65	1.69	1.02	.....
29	.40	.....	.56	.76	1.05	1.86	1.67	1.67	1.01	.....
30	.42	.....	.65	.77	1.05	1.87	1.60	1.66	1.00	.....
31	.46	.....	.52	.....	1.06	.....	1.60	1.66	.....	.....

Daily discharge, in second-feet, of Shoshone River and sluices at Corbett dam, Wyo., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	265	428	254	566	890	1,740	3,850	3,610	3,080	1,360
2	276	386	265	715	800	1,810	3,850	3,660	3,060	1,380
3	414	442	265	715	783	1,900	3,790	3,660	2,970	1,380
4	344	287	287	486	766	1,880	3,790	3,660	2,940	1,380
5	400	287	319	582	836	2,180	3,850	3,690	2,880	1,310
6	486	319	319	518	980	2,310	3,790	3,690	2,830	1,270
7	414	308	330	566	1,020	1,880	3,790	3,690	2,800	1,250
8	287	254	372	534	1,080	2,100	3,790	3,630	2,830	1,180
9	265	221	386	582	1,160	2,290	3,790	3,660	2,800	1,140
10	414	243	265	566	1,220	2,340	3,790	3,660	2,740	1,120
11	308	276	358	550	1,180	2,390	3,750	3,630	2,660	1,040
12	414	308	265	486	1,140	2,390	3,790	3,560	2,550	962
13	534	344	287	582	1,060	2,470	3,790	3,590	2,500	800
14	944	265	344	414	1,160	2,550	3,790	3,530	2,470	534
15	630	265	386	470	1,180	2,740	3,750	3,530	2,470	534
16	372	265	414	414	1,180	2,910	3,750	3,500	2,470	518
17	344	308	442	470	1,180	3,030	3,790	3,500	2,420	442
18	372	232	566	550	1,180	3,140	3,790	3,440	2,210	456
19	319	276	400	598	1,180	3,230	3,750	3,380	2,130	428
20	319	276	486	582	1,250	3,320	3,850	3,350	2,080	330
21	330	265	582	598	1,220	3,380	3,750	3,350	2,060	287
22	232	232	664	766	1,250	3,470	3,960	3,350	1,880	232
23	232	210	681	783	1,250	3,530	4,030	3,290	1,620	265
24	400	232	715	550	1,220	3,530	3,940	3,260	1,520	265
25	344	265	681	550	1,180	3,530	3,960	3,260	1,500	265
26	344	456	550	647	1,270	3,660	3,870	3,260	1,500	.....
27	344	386	470	766	1,590	3,690	3,840	3,200	1,470	.....
28	330	276	428	836	1,660	3,630	3,810	3,200	1,456	.....
29	330	.....	566	908	1,520	3,720	4,020	3,140	1,420	.....
30	358	.....	715	926	1,520	3,750	4,110	3,110	1,400	.....
31	414	.....	502	.....	1,540	.....	4,110	3,110	.....	.....

Monthly discharge of Shoshone River and sluices at Corbett dam, Wyoming, for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	944	232	380	23,400
February	456	210	297	16,500
March	715	254	438	26,900
April	926	414	609	36,200
May	1,600	766	1,180	72,000
June	3,750	1,740	2,820	168,000
July	4,110	3,770	3,850	237,000
August	3,620	3,110	3,400	213,000
September	3,080	1,400	2,270	136,000
October 1–25	1,380	232	805	39,900
The period				970,000

Daily discharge, in second-feet, of Corbett tunnel at Corbett dam, Wyoming, for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1			62	132	132	194		114
2			62	112	120	162		88
3			62	160	166	128		84
4			70	226	182	96		90
5			94	0	200	96	170	100
6			134	90	224	96	158	104
7	15		112	386	224	96	138	116
8	51		118	304	260	80	58	130
9	51		136	276	296	64	64	140
10	18		170	256	320	64	64	144
11			186	256	296	64	94	132
12			172	256	272	66	102	108
13			164	260	308	84	120	98
14			176	288	328	112	122	110
15			186	326	338	128	116	116
16			172	332	284	128	120	132
17			158	282	276	150	122	146
18	15		154	252	296	180	118	158
19	51	8	162	252	250	200	122	168
20	51	0	158	252	192	160	120	196
21	40	44	176	218	158	140	116	236
22		84	186	162	128	174	116	
23		68	186	142	128	220	110	
24		44	200	170	150	236	98	
25		44	206	142	194	214	88	
26		52	78	0	238	184	78	
27		84	34	58	252		66	
28		60	74	278	216		62	
29		44	108	236	174		94	
30		54	148	190	148		114	
31			154		180			

Monthly discharge of Corbett tunnel at Corbett dam, Wyoming, for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 7–10, 18–21	51	15	36.5	579
April 19–30	84	0	48.8	1,160
May	206	34	137	8,420
June	386	0	210	12,500
July	338	120	224	13,800
August 1–26	236	64	135	6,960
September 5–30	170	58	106	5,470
October 1–21	236	84	129	5,370

NOTE.—No records available for Aug. 27 to Sept. 4 and after Oct. 21. Daily discharges were computed considering the gate openings as submerged orifices. Considering the uncertainties involved in the method of computation, the accuracy of the above monthly means is not better than "C."

SOAP CREEK NEAR ST. XAVIER, MONT.

Location.—One-fourth mile above the headworks of Soap Creek ditch, in the W. ½ NW. ¼ sec. 2, T. 6 S., R. 32 E., about 11 miles southeast of St. Xavier, Mont.

Records available.—September 11 to November 11, 1911.

Drainage area.—Not measured.

Gage.—An overhanging chain gage on the left bank about 100 feet above the ford.

Channel.—Permanent; bed of stream is gravel and sand at gage and firm gravel and cobblestones at the control 50 feet below the gage.

Discharge measurements.—Made by wading at the ford 100 feet below the gage.

Winter flow.—Stream frozen during the winter months; winter gage heights of no value.

Diversion.—None above gage.

The following discharge measurement was made by W. A. Lamb:

September 11, 1911: Gage height, 3.05 feet; discharge, 13 second-feet.

Daily gage height, in feet, of Soap Creek near St. Xavier, Mont., for 1911.

[W. G. Wanett, observer.]

Day.	Sept.	Oct.	Nov.	Day.	Sept.	Oct.	Nov.	Day.	Sept.	Oct.	Nov.
1		3.11		11	3.05		2.95	21		3.15	
2				12				22	3.08		
3				13				23			
4			3.14	14	3.08	3.15		24	3.12		
5				15				25			
6				16	3.10			26	3.10		
7				17				27			
8				18	3.10			28	3.12	2.98	
9				19				29			
10				20	3.10			30			

ROTTENGRASS CREEK NEAR ST. XAVIER, MONT.

Location.—One-fourth mile above the crossing of the Bighorn canal, in the SW ¼ SW. ¼ sec. 31, T. 4 S., R. 33 E.; about 4 miles southeast of St. Xavier, Mont.

Records available.—September 9 to November 11, 1911.

Gage.—Overhanging chain gage on left bank.

Channel.—Liable to change; bed of stream is composed of sand and silt. The channel is deep and the current sluggish for several hundred feet above and below the gage.

Discharge measurements.—Made by wading above the gage.

Winter flow.—Channel freezes during the winter months; winter gage heights of no value.

Diversions.—None.

The following discharge measurement was made by W. A. Lamb:

September 9, 1911: Gage height, 2.29 feet; discharge, 0.3 second-foot

Daily gage height, in feet, of Rottengrass Creek at St. Xavier, Mont., for 1911.

[W. H. Broadbent, observer.]

Day.	Sept.	Oct.	Nov.	Day.	Sept.	Oct.	Nov.	Day.	Sept.	Oct.	Nov.
1				11			3.15	21		2.97	
2				12	2.61	2.98		22			
3		2.70		13		2.97		23			
4				14	2.53	2.96		24	2.32	3.02	
5				15				25			
6		2.97		16	2.47	3.37		26			
7				17		3.18		27	2.30	3.10	
8				18		3.10		28			
9		2.96		19		3.23		29			
10		2.96		20		2.98		30		3.18	
								31			

LODGEGRASS CREEK NEAR LODGEGRASS, MONT.

Location.—Above road crossing one-fourth mile above headworks of Lodgegrass ditch, in the SW. ¼ sec. 29, T. 6 N., R. 35 E., about 6 miles southwest of Lodgegrass, Mont.

Records available.—September 9 to December 31, 1911.

Drainage area.—Not measured.

Gage.—Overhanging chain gage on left bank, 50 feet above the road crossing.

Channel.—Permanent at control below the gage. Bed of stream is composed of mud and silt at the gage, but of firm gravel and cobblestones at the ford below the gage. Current sluggish at gage at low stages.

Discharge measurements.—Made by wading at the ford below the gage.

Winter flow.—Stream freezes over during winter months; winter gage heights of no value.

Diversion.—None.

The following discharge measurement was made by W. A. Lamb:

September 8, 1911; Gage height, 3.22 feet; discharge, 16 second-feet.

TONGUE RIVER BASIN.

TONGUE RIVER NEAR DAYTON, WYO.

Location.—At the edge of the Bighorn National Forest, in the NE. ¼ sec. 11, T. 56 N., R. 87 W., 3 miles southwest of Dayton; 3¾ miles below the mouth of Sheep Creek.

Records available.—October 24 to December 16, 1911. From May 3 to October 31, 1903, a station was maintained at Dayton.

Drainage area.—214 square miles (measured from topographic sheets).

Gage.—Vertical staff.

Channel.—Apparently permanent.

Discharge measurements.—Made from highway bridge 2 miles below station during high water, and by wading at the gage at ordinary stages.

Winter flow.—Ice causes some backwater during the winter months.

Diversions.—The only diversion above the station is a log flume which heads 15 miles above. One hundred feet below the station is the intake for the Highline Community ditch. Prior to July 1, 1912, there were adjudicated diversions from Tongue River amounting to 213 second-feet in Wyoming.

Accuracy.—Owing to a lack of discharge measurements no estimates of flow have been made.

Cooperation.—Station is maintained in cooperation with the United States Forest Service.

The following discharge measurement was made by H. B. Waha:

October 24, 1911: Gage height, 1.50 feet; discharge, 63 second-feet.

Daily gage height, in feet, of Tongue River near Dayton, Wyo., for 1911.

[H. E. Anderson, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1			1.5	11				21		1.5	
2			1.4	12				22		1.4	
3				13			1.4	23			
4			1.4	14			1.4	24	1.5	1.4	
5			1.4	15			1.4	25	1.6		
6			1.4	16			1.4	26			
7			1.4	17				27			
8			1.4	18				28		a 2.0	
9			1.4	19				29		a 2.0	
10				20		1.5		30		1.5	
								31			

a Ice caused backwater.

TONGUE RIVER AT CARNEYVILLE, WYO.

Location.—At the highway bridge at Carneyville, Wyo., about 2 miles above the mouth of Big Goose Creek.

Records available.—May 25, 1911, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Standard chain gage on highway bridge.

Channel.—Believed to be permanent; bed of stream is composed of gravel and cobblestones.

Discharge measurements.—Made from bridge at high stages and by wading at low and medium stages.

Winter flow.—Gage heights affected by ice during the winter months.

Diversion.—See Tongue River near Dayton, Wyo.

Discharge measurements of Tongue River at Carneyville, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 5	W. A. Lamb	3.44	285
June 17	R. Richards	3.82	436
July 31	B. E. Jones	2.77	82
Sept. 7	R. Richards	2.70	73
Nov. 18a	W. A. Lamb	3.15	84

a Ice conditions.

Daily gage height, in feet, of Tongue River at Carneyville, Wyo., for 1911.

[John Bone, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		4.2	3.2	2.85	2.7	2.75	2.85	16	4.15	3.95	2.75	2.7	2.7	2.95	3.15
2		4.2	3.05	2.8	2.7	2.85	2.85	17	3.65	3.7	2.8	2.7	2.7	2.85	3.35
3		4.0	3.15	2.8	2.7	2.85	2.9	18	3.7	3.65	2.85	2.7	2.75	2.95	3.05
4		4.0	3.0	2.8	2.65	2.85	2.9	19	3.6	3.65	2.8	2.6	2.9	2.9	3.15
5		4.1	3.0	3.1	2.75	2.85	2.85	20	3.5	3.5	2.85	2.5	2.95	2.8	3.1
6		3.9	2.9	2.9	2.65	2.85	2.85	21	3.45	3.4	2.85	2.5	2.9	2.8	3.05
7		3.8	2.85	2.85	2.7	2.85	2.85	22	3.6	3.4	2.85	2.7	2.9	2.9	3.0
8		3.85	2.85	2.9	2.95	2.8	2.85	23	3.55	3.65	2.8	2.65	2.9	2.9	3.0
9		3.75	2.85	2.9	2.8	2.8	2.75	24	3.6	3.45	2.8	2.8	2.95	2.85	3.0
10		3.7	2.85	2.85	2.7	2.85	2.95	25	3.65	3.3	2.8	2.8	2.9	2.95	2.95
11		3.6	2.8	2.85	2.65	2.8	3.05	26	3.85	3.35	2.75	2.65		2.9	3.0
12		3.6	2.85	2.9	2.6	2.75	3.2	27	3.75	3.35	2.6	2.7		2.65	2.9
13		3.5	2.85	2.9	2.5	3.05	3.25	28	3.65	3.2	2.6	2.7		2.7	3.05
14		3.6	2.8	2.9	2.55	2.85	3.25	29	3.65	3.05	2.65	2.7		2.8	3.1
15	3.7	3.85	2.85	2.7	2.6	3.0	3.25	30	3.7	3.0	2.65	2.65		2.75	3.25
								31	3.7		2.7	2.7		2.85	

NOTE.—Gage heights distorted by ice Nov. 10 to 30.

Daily discharge, in second-feet, of Tongue River at Carneyville, Wyo., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1....	200	603	200	101	72	81	101	16....	580	490	81	72	72	125	.....
2....	220	603	153	90	72	101	101	17....	365	384	90	72	72	101	.....
3....	240	513	184	90	72	101	112	18....	384	365	101	72	81	125	.....
4....	260	513	138	90	65	101	112	19....	345	365	90	58	112	112	.....
5....	285	558	138	108	81	101	101	20....	307	307	101	49	125	90	.....
6....	295	468	112	112	65	101	101	21....	288	270	101	49	112	90	.....
7....	305	425	101	101	72	101	101	22....	345	270	101	72	112	112	.....
8....	315	446	101	112	125	90	101	23....	326	365	90	65	112	112	.....
9....	325	404	101	112	90	90	81	24....	315	288	90	90	125	101	.....
10....	335	384	101	101	72	101	.....	25....	365	234	90	90	112	125	.....
11....	345	345	90	101	65	90	.....	26....	445	252	81	65	107	112	.....
12....	355	345	101	112	58	81	.....	27....	401	252	58	72	102	65	.....
13....	365	307	101	112	49	153	.....	28....	365	200	58	72	97	72	.....
14....	375	345	90	112	54	101	.....	29....	365	153	65	72	92	90	.....
15....	384	446	101	72	58	138	.....	30....	384	138	65	65	87	81	.....
								31....	384	.....	72	72	.....	101	.....

NOTE.—Daily discharge determined from a rating curve fairly well defined between 60 and 500 second-feet; discharge estimated May 1 to 4, May 6 to 14, and Sept. 26 to 30.

Monthly discharge of Tongue River at Carneyville, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	580	200	342	21,000	C.
June	603	138	368	21,900	C.
July	200	58	101	6,210	C.
August	168	49	86.9	5,340	C.
September	125	49	86.3	5,140	C.
October	153	65	101	6,210	C.
November	112	75	82.9	4,930	C.
December	.....	.....	*a* 50	3,070	C.
The period	.....	.....	.....	73,800	

a Estimated.

NOTE.—Estimated discharge Nov. 10 to 30, 75 second-feet.

GOOSE CREEK AT SHERIDAN, WYO.

Location.—At footbridge in city park at Sheridan, Wyo.

Records available.—From April 10, 1896, to August 1, 1897, and from May 14 to December 31, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff attached to under pier of the footbridge. The gage readings from April 10, 1896, to August, 1897, were made from a gage at the Fifth Avenue Bridge, below the mouth of Little Goose Creek.

Channel.—Practically permanent; bed of stream is composed of gravel and cobblestones.

Discharge measurements.—Made from the footbridge at high stages and by wading at low stages.

Winter flow.—Gage heights during winter months are affected by ice at the gage.

Diversion.—During the irrigation season the greater part of the flow is diverted for irrigation above the gage. About 7,500 acre-feet of water are stored in the mountains on the headwaters of the stream and diverted in the Little Goose Creek drainage area. There are also a number of smaller diversions into the Little Goose Creek drainage area after the stream leaves the mountains. The records at the station show the amount of water that is not used in the Big Goose drainage basin.

Discharge measurements of Goose Creek at Sheridan, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 14	W. A. Lamb	4.06	131
June 16	R. Richards	5.02	493
July 31	B. E. Jones	2.95	5.5
Sept. 10	R. Richards	3.20	18.2
Nov. 18[a]	W. A. Lamb	3.55	38

[a] Ice conditions.

Daily gage height, in feet, of Goose Creek at Sheridan, Wyo., for 1911.

[H. A. Loucks, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	4.50	3.19	3.06	3.00	3.26	3.35	16	4.60	5.10	2.88	3.07	3.12	3.32	3.60
2	.....	4.80	3.20	3.04	2.99	3.26	3.50	17	4.80	4.80	2.86	3.05	3.19	3.38	3.54
3	.....	5.00	3.32	3.28	2.98	3.30	3.49	18	4.60	4.32	2.85	3.05	3.17	3.37	3.51
4	.....	4.70	3.44	3.24	3.02	3.26	3.43	19	4.46	4.45	2.87	3.08	3.20	3.32	3.46
5	.....	4.80	3.12	3.48	3.06	3.30	3.38	20	4.42	4.37	2.88	3.10	3.24	3.42	3.46
6	.....	4.70	3.18	3.62	3.15	3.28	3.42	21	4.38	4.50	2.88	2.96	3.26	3.31	3.41
7	.....	4.35	3.28	3.43	3.20	3.29	3.40	22	4.42	4.38	2.84	2.90	3.24	3.26	3.40
8	.....	4.50	3.28	3.40	3.36	3.22	3.40	23	4.14	4.18	2.88	2.88	3.25	3.27	3.46
9	.....	4.60	3.15	3.40	3.24	3.20	3.38	24	4.02	4.11	3.20	2.94	3.26	3.44	3.40
10	.....	4.60	3.18	3.42	3.20	3.19	3.42	25	4.00	4.04	3.30	3.02	3.22	3.48	.....
11	.....	4.20	3.14	3.40	3.19	3.20	3.60	26	4.26	3.90	3.30	3.00	3.25	3.50	.....
12	.....	4.17	3.19	3.34	3.14	3.20	3.60	27	4.34	3.64	3.32	3.01	3.16	3.30	.....
13	.....	4.42	3.05	3.38	3.09	3.28	3.65	28	4.09	3.55	3.32	3.02	3.20	3.27	.....
14	4.05	4.65	2.91	3.18	3.16	3.36	3.66	29	3.94	3.39	3.26	3.00	3.23	3.34	.....
15	4.45	5.05	2.92	3.10	3.14	3.27	3.68	30	4.02	3.24	3.15	3.00	3.30	3.42	.....
								31	4.23	.....	2.98	3.00	.....	3.44	.....

NOTE.—Gage heights distorted by ice after Nov. 11.

Daily discharge, in second-feet, of Goose Creek at Sheridan, Wyo., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	255	17	10	8.0	22	29	16	295	530	3.6	11	13	27	.....
2	.....	380	18	9.6	7.6	22	43	17	380	380	3.2	10	17	31	.....
3	.....	480	27	24	7.2	25	42	18	295	196	3.0	10	16	31	.....
4	.....	335	37	21	8.8	22	36	19	241	238	3.4	11	18	27	.....
5	.....	380	13	41	10	25	31	20	227	211	3.6	12	21	35	.....
6	.....	335	17	58	15	24	35	21	214	255	3.6	6.4	22	26	.....
7	.....	205	24	36	18	24	33	22	227	214	2.8	4.0	21	22	.....
8	.....	255	24	33	30	19	33	23	150	160	3.6	3.6	22	23	.....
9	.....	295	15	33	21	18	31	24	123	142	18	5.6	22	37	.....
10	.....	295	17	35	18	17	35	25	119	127	25	8.8	19	41	.....
11	.....	165	14	33	17	18	.....	26	180	101	25	8.0	22	43	.....
12	.....	158	17	28	14	18	.....	27	202	61	27	8.4	16	25	.....
13	.....	227	10	31	12	24	.....	28	138	49	27	8.8	18	23	.....
14	130	315	4.4	17	16	30	.....	29	109	32	22	8.0	19	28	.....
15	238	505	4.8	12	14	23	.....	30	123	21	15	8.0	25	35	.....
								31	172	.....	7.2	8.0	.....	37	.....

NOTE.—Daily discharge determined from a fairly well defined rating curve.

Monthly discharge of Goose Creek at Sheridan, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May 14-31	380	119	198	7,080	B.
June	530	21	243	14,500	B.
July	57	2.8	14.6	898	B.
August	58	3.6	17.8	1,090	B.
September	30	7.2	16.9	1,010	B.
October	43	17	26.5	1,630	B.
November	43	29	31.6	1,880	C.
December			[a] 25	1,540	D.
The period				29,600	

[a] Estimated.

NOTE.—Discharge Nov. 11 to 30 estimated at 30 second-feet.

LITTLE GOOSE CREEK AT SHERIDAN, WYO.

Location.—At the footbridge about 200 yards above the point where the stream parallels the Chicago, Burlington & Quincy Railroad and about one-fourth mile above the junction with Goose Creek at Sheridan, Wyo.

Records available.—May 1, 1896, to August 1, 1897; May 14 to December 31, 1911.

Gage.—A staff attached to the downstream end of the right abutment of the footbridge. The gage read from May 1, 1896, to August 1, 1897, was at the Broadway Bridge, 600 feet below the site of the present gage.

Channel.—Liable to shift; bed of stream is composed of sand and gravel.

Discharge measurements.—Made from the downstream side of the footbridge; low-water measurements are made by wading.

Winter flow.—Stream freezes solid at the control below gage.

Diversions.—During the irrigation season, from May to September, the greater part of the stream is diverted for irrigation above the station. The records at this point show the amount of water that is not being used for irrigation.

Accuracy.—Results for 1911 are believed to be good. The shifting character of the channel may affect future results.

Discharge measurements of Little Goose Creek at Sheridan, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 14	W. A. Lamb	2.75	3.2
June 16	R. Richards	3.42	86
July 31	R. E. Jones	2.65	1.10
Sept. 10	R. Richards	2.72	2.9
Nov. 18[a]	W. A. Lamb	3.55	35

[a] Ice conditions.

Daily gage height, in feet, of Little Goose Creek at Sheridan, Wyo., for 1911.

[W. E. Hammontree, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.85	2.72	2.70	2.80	2.98	3.00	16	3.40	3.45	2.62	2.82	2.75	3.00	3.50
2	.....	2.95	2.72	2.65	2.80	3.00	3.02	17	3.25	3.10	2.62	2.85	2.80	3.00	3.50
3	.....	2.85	2.65	2.70	2.80	3.00	3.02	18	3.15	2.95	2.70	2.82	2.85	3.00	3.50
4	.....	2.80	2.62	2.65	2.80	3.00	3.02	19	3.08	2.90	2.75	2.75	2.90	3.00	3.45
5	.....	2.70	2.62	2.65	2.80	3.00	3.02	20	2.98	2.80	2.72	2.70	2.90	3.02	3.40
6	.....	2.80	2.60	2.80	2.88	3.00	3.02	21	2.90	2.85	2.70	2.70	2.90	3.00	3.40
7	.....	2.65	2.70	2.80	2.80	3.00	3.02	22	2.80	2.90	2.70	2.70	2.90	3.00	3.40
8	.....	2.70	2.65	2.80	2.80	3.00	3.05	23	2.75	2.85	2.70	2.80	2.90	3.00	3.40
9	.....	2.65	2.75	2.70	2.78	3.00	3.05	24	2.70	2.70	2.70	2.75	2.90	3.00	.....
10	.....	2.65	2.62	2.70	2.78	3.00	3.05	25	2.85	2.60	2.70	2.80	2.90	3.00	.....
11	.....	2.60	2.65	2.90	2.78	3.00	3.05	26	3.00	2.65	2.70	2.80	2.92	3.00	.....
12	.....	2.60	2.65	2.90	2.80	3.00	3.05	27	3.10	2.62	2.70	2.75	3.00	3.00	.....
13	.....	2.60	2.65	2.88	2.80	3.00	3.05	28	3.05	2.66	2.70	2.80	2.95	3.00	.....
14	2.75	2.60	2.65	2.88	2.75	3.00	3.05	29	2.85	2.65	2.62	2.80	2.98	3.00	.....
15	3.06	3.00	2.62	2.90	2.72	3.00	3.42	30	2.70	2.65	2.62	2.80	2.98	3.00	.....
								31	2.70	.....	2.60	2.80	.....	3.00	.....

NOTE.—Gage heights distorted by ice after Nov. 14.

Daily discharge, in second-feet, of Little Goose Creek at Sheridan, Wyo., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	9.0	2.7	1.9	6.0	20	22	16	82	92	0.4	7.2	4.0	22	.....
2	.....	17	2.7	1.0	6.0	22	24	17	56	34	.4	9.0	6.0	22	.....
3	.....	9.0	1.0	1.9	6.0	22	24	18	41	17	1.9	7.2	9.0	22	.....
4	.....	6.0	.4	1.0	6.0	22	24	19	32	12	4.0	4.0	12	22	.....
5	.....	1.9	.4	1.0	6.0	22	24	20	20	6.0	2.7	1.9	12	24	.....
6	.....	6.0	.0	6.0	11	22	24	21	12	9.0	1.9	1.9	12	22	.....
7	.....	1.0	1.9	6.0	6.0	22	24	22	6.0	12	1.9	1.9	12	22	.....
8	.....	1.9	1.0	6.0	6.0	22	28	23	4.0	9.0	1.9	6.0	12	22	.....
9	.....	1.0	4.0	1.9	5.2	22	28	24	1.9	1.9	1.9	4.0	12	22	.....
10	.....	1.0	.4	1.9	5.2	22	28	25	9.0	.0	1.9	6.0	12	22	.....
11	.....	.0	1.0	12	5.2	22	28	26	22	1.0	1.9	6.0	14	22	.....
12	.....	.0	1.0	12	6.0	22	28	27	34	.4	1.9	4.0	22	22	.....
13	.....	.0	1.0	11	6.0	22	28	28	28	1.1	1.9	6.0	17	22	.....
14	4.0	.0	1.0	11	4.0	22	28	29	9.0	1.0	.4	6.0	20	22	.....
15	29	22	.4	12	2.7	22	.....	30	1.9	1.0	.4	6.0	20	22	.....
								31	1.9	.....	.0	6.0	.....	22	.....

NOTE.—Daily discharge determined from a fairly well defined rating curve.

Monthly discharge of Little Goose Creek at Sheridan, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May 14-31	82	1.9	21.9	782	C.
June	92	.0	9.11	542	C.
July	4.0	.0	1.43	87.9	C.
August	12	1.0	5.47	336	C.
September	22	2.7	6.65	397	C.
October	24	20	22.0	1,350	C.
November	28	22	25.4	1,510	D.
December	.....	.....	[a] 15	922	
The period	.....	.....	.....	5,390	

[a] Estimated.

NOTE.—Discharges Nov. 15 to 30 estimated at 25 second-feet.

POWDER RIVER BASIN.

SOUTH FORK OF POWDER RIVER NEAR KAYCEE, WYO.

Location.—At Z. W. French's ranch, about 7 miles southeast of Kaycee, Wyo.

Records available.—May 11 to December 31, 1911.

Gage.—An overhanging chain gage on left bank of the stream opposite the ranch buildings.

Channel.—Liable to change; bed composed of gravel and sand.

Discharge measurements.—Made by wading near the gage.

Winter records.—Gage heights are affected by ice during the winter months. The stream freezes solid at times.

Diversion.—Small diversions for irrigation are made above the stations.

Accuracy.—On account of the shifting channel results are only fair.

Discharge measurements of South Fork of Powder River near Kaycee, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 11	W. A. Lamb	5.88	110
June 20	R. Richards	5.39	30
Sept. 8	do	4.60	1.8

Daily gage height, in feet, of South Fork of Powder River near Kaycee, Wyo., for 1911.

[Z. W. French, observer.]

Day.	May.	June.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	Aug.	Sept.	Oct.	Nov.
1	.....	5.0	6.3	.....	8.5	4.9	16	5.3	.....	.....	4.8	5.05	5.2
2	.....	5.0	6.1	.....	5.95	4.9	17	5.3	.....	.....	4.8	5.0	5.5
3	.....	5.0	6.4	.....	5.3	5.2	18	5.2	.....	.....	4.8	5.1	5.3
4	.....	5.0	5.4	.....	5.1	5.0	19	5.3	.....	.....	4.8	5.1	.....
5	.....	5.9	7.1	.....	5.0	5.0	20	5.2	5.4	.....	4.8	4.9	.....
6	.....	5.9	.....	.....	5.0	5.0	21	5.2	5.4	.....	4.8	4.9	.....
7	.....	5.7	.....	.....	5.0	5.0	22	5.2	5.0	.....	4.8	4.9	.....
8	.....	5.6	.....	4.6	5.0	5.0	23	5.2	5.0	.....	4.8	4.9	.....
9	.....	5.5	.....	4.6	5.0	5.3	24	5.2	0.0	.....	4.9	4.9	.....
10	.....	5.3	.....	4.6	4.9	5.1	25	5.1	0.0	.....	4.9	4.95	.....
11	5.8	5.2	.....	4.6	4.9	5.0	26	5.0	0.0	.....	4.9	4.95	.....
12	5.6	.....	.....	4.6	4.9	5.0	27	5.0	0.0	.....	4.9	4.9	.....
13	5.4	.....	.....	4.7	4.9	5.0	28	5.0	0.0	.....	4.9	4.9	.....
14	5.2	.....	.....	4.7	5.0	5.2	29	5.0	0.0	.....	4.9	4.9	.....
15	5.5	.....	.....	4.7	5.5	5.1	30	5.0	0.0	.....	4.9	4.9	.....
							31	5.0	.....	.....	.....	4.9	.....

MIDDLE FORK OF POWDER RIVER AT KAYCEE, WYO.

Location.—At highway bridge at Kaycee, Wyo.

Records available.—May 11 to December 31, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff attached to the middle pier of the highway bridge.

Channel.—Permanent at control but shifting at gage. The bed of the stream is composed of gravel and cobblestones. Current sluggish at low water.

Discharge measurements.—Made from bridge at high stages and by wading at low stages.

Winter flow.—Gage heights during the winter months are affected by ice.

Diversion.—The greater part of the flow is diverted above the gage during the irrigation season.

Discharge measurements of Middle Fork of Powder River at Kaycee, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 10	W. A. Lamb	4.10	365
11	do	3.55	162
June 20	R. Richards	3.13	64
July 29	B. E. Jones	2.77	7.6
Sept. 8	R. Richards	3.06	45

Daily gage height, in feet, of Middle Fork of Powder River at Kaycee, Wyo., for 1911.

[P. A. Gatchell, jr., observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.4	3.0	2.95	3.0	3.4	3.25	16	3.65	3.7	2.8	3.0	3.0	3.1	.....
2	.....	3.4	3.0	2.9	3.0	3.2	3.25	17	3.5	3.35	2.8	3.0	3.0	3.2	.....
3	.....	3.4	2.95	2.9	3.0	3.2	3.3	18	3.45	3.3	2.8	3.0	3.05	3.2	.....
4	.....	3.4	2.95	2.85	3.0	3.15	3.3	19	3.45	3.2	2.8	3.0	3.05	3.2	.....
5	.....	3.4	2.9	2.8	3.0	3.1	3.2	20	3.45	3.1	2.8	3.0	3.05	3.15	.....
6	.....	3.35	2.9	4.0	3.2	3.1	3.2	21	3.5	3.1	2.8	3.0	3.1	3.1	.....
7	.....	3.3	2.9	3.9	3.1	3.1	3.2	22	3.5	3.2	2.8	3.0	3.1	3.1	.....
8	.....	3.3	2.9	3.1	3.05	3.2	3.2	23	3.5	3.1	2.8	3.0	3.1	3.15	.....
9	.....	3.2	2.9	3.1	3.0	3.1	3.2	24	3.5	3.1	2.8	3.05	3.1	3.15	.....
10	.....	3.2	2.85	3.1	3.0	3.1	3.15	25	3.5	3.15	2.8	3.05	3.1	3.15	.....
11	.....	3.2	2.85	3.1	3.0	3.1	3.15	26	3.5	3.1	2.8	3.05	3.1	3.15	.....
12	3.5	3.15	2.85	3.0	3.0	3.1	.....	27	3.5	3.1	2.8	3.05	3.1	3.2	.....
13	3.5	3.1	2.8	3.0	3.0	3.1	.....	28	3.5	3.1	2.8	3.0	3.1	3.2	.....
14	3.48	3.0	2.8	3.0	3.0	3.1	.....	29	3.45	3.0	2.8	3.0	3.1	3.2	.....
15	3.7	3.2	2.8	3.0	3.0	3.2	.....	30	3.45	3.0	2.8	3.0	3.1	3.2	.....
								31	3.45	.....	3.1	3.0	.....	3.2	.....

Daily discharge, in second-feet, of Middle Fork of Powder River at Kaycee, Wyo., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	120	36	29	36	120	84	16	194	210	10	36	36	53	.....
2	.....	120	36	22	36	73	84	17	147	108	10	36	36	73	.....
3	.....	120	29	22	36	73	95	18	134	95	10	36	44	73	.....
4	.....	120	29	16	36	63	95	19	134	73	10	36	44	73	.....
5	.....	120	22	10	36	53	73	20	134	53	10	36	44	63	.....
6	.....	108	22	325	73	53	73	21	147	53	10	36	53	53	.....
7	.....	95	22	285	53	53	73	22	147	73	10	36	53	53	.....
8	.....	95	22	53	44	73	73	23	147	53	10	36	53	63	.....
9	.....	73	22	53	36	53	73	24	147	53	10	44	53	63	.....
10	.....	73	16	53	36	53	63	25	147	63	10	44	53	63	.....
11	.....	73	16	53	36	53	63	26	147	53	10	44	53	63	.....
12	147	63	16	36	36	53	.....	27	147	53	10	44	53	73	.....
13	147	53	10	36	36	53	.....	28	147	53	10	36	53	73	.....
14	142	36	10	36	36	53	.....	29	134	36	10	36	53	73	.....
15	210	73	10	36	36	73	.....	30	134	36	10	36	53	73	.....
								31	134	.....	53	36	.....	73	.....

NOTE.—Daily discharge determined from a well-defined rating curve.

Monthly discharge of Middle Fork of Powder River at Kaycee, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	210	134	144	8,850	B.
June	210	36	80.2	4,770	A.
July	53	10	16.8	1,030	A.
August	325	10	54.0	3,320	A.
September	73	36	44.5	2,650	A.
October	120	53	64.8	3,980	A.
November	95	50	60.0	3,570	C.
The period				28,200	

NOTE.—Discharge May 1 to 11 estimated at 135 second-feet. Nov. 12 to 30 estimated at 50 second-feet.

NORTH FORK OF POWDER RIVER NEAR KAYCEE, WYO.

Location.—At Jacob Affalter's ranch, on the county road 4 miles north of Kaycee, Wyo.

Records available.—May 11 to December 31, 1911.

Drainage area.—Not measured.

Gage.—An overhanging chain gage on the left bank one-fourth mile above the highway bridge. From May 11 to July 28, 1911, the gage was located 200 feet farther upstream and at a different datum. It was moved because it was within the influence of backwater from beaver dams.

Channel.—Practically permanent. The bed of the stream at the point of control below the gage is composed of permanent gravel and cobblestones, but at the gage it is composed of sand and gravel and is liable to shift during high stages.

Discharge measurements.—Made from the highway bridge one-fourth mile below the gage at high stages and by wading near the gage at low and medium stages.

Winter flow.—Gage heights are affected by ice during the winter months. The channel water is frozen solid at times.

Diversions.—During the irrigation season the greater part of the flow of the stream is diverted above the station.

Accuracy.—Fair. Gage heights before July 28 were affected by backwater from a beaver dam below the gage. After July 28 the records are considered good.

Discharge measusements of North Fork of Powder River near Kaycee, Wyo., for 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 11	W. A. Lamb	4.72	45
June 20	R. Richards	4.08	6.8
July 29[a]	B. E. Jones	3.25	0.92
Sept. 8[a]	R. Richards	3.51	12.9

[a] New gage 300 feet below old station.

Daily gage height, in feet, of North Fork of Powder River near Kaycee, Wyo., for 1911.

[Jacob Affalter, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June	July.	Aug.	Sept.	Oct.	Nov.
1	.....	4.50	4.00	3.80	3.32	4.30	3.70	16	5.45	4.15	4.00	3.32	3.30	3.58	3.90
2	.....	4.45	4.15	3.40	3.32	4.00	3.70	17	4.81	4.20	4.00	3.35	3.30	3.60	3.90
3	.....	4.42	4.10	3.30	3.35	4.00	3.75	18	4.66	4.20	4.00	3.30	3.30	3.68	3.90
4	.....	4.36	4.08	3.30	3.35	3.80	3.85	19	4.54	4.15	4.00	3.35	3.30	3.70	3.90
5	.....	4.35	4.00	3.30	3.35	3.70	3.85	20	4.55	4.10	4.05	3.40	3.30	3.70	3.90
6	.....	4.08	4.05	3.40	3.35	3.60	3.82	21	4.54	4.10	4.00	3.40	3.30	3.70	3.90
7	.....	3.95	4.00	3.30	3.30	3.60	3.80	22	4.50	4.10	4.00	3.40	3.30	3.70	3.90
8	.....	3.88	4.00	3.30	3.30	3.60	3.80	23	4.74	4.00	.....	3.32	3.30	3.70	3.85
9	.....	3.85	4.05	3.20	3.30	3.60	3.80	24	4.50	4.00	.....	3.35	3.40	3.70	3.85
10	.....	3.85	4.00	3.20	3.30	3.60	3.70	25	4.45	4.00	.....	3.32	3.45	3.70	3.80
11	4.72	4.06	4.00	3.30	3.30	3.58	3.80	26	4.50	4.00	.....	3.35	3.45	3.70	3.80
12	4.52	4.10	4.00	3.30	3.30	3.58	3.90	27	4.58	4.10	.....	3.38	3.45	3.68	3.80
13	4.50	3.98	4.00	3.30	3.30	3.58	3.90	28	4.60	4.10	3.25	3.30	3.50	3.68	3.80
14	4.51	4.08	4.00	3.40	3.30	3.58	3.85	29	4.58	4.05	3.25	3.30	3.60	3.68	3.80
15	5.18	4.15	4.00	3.30	3.30	3.58	3.85	30	4.78	4.00	3.30	3.30	3.60	3.70	3.80
								31	4.56	.....	4.00	3.32	.....	3.70	.....

CLEAR CREEK NEAR BUFFALO, WYO.

Location.—In the Bighorn National Forest, at Camp Comfort, in the SW. ¼ sec. 8, T. 50 N., R. 83 W., 11 miles west of Buffalo; three-fourths of a mile below the junction of the North and South forks.

Records available.—October 22, to December 31, 1911. From May 1, 1896, to March 11, 1900, a station was maintained by the State engineer at a point 4 miles west of Buffalo, where a measuring flume was built. From October 24, 1902, to December 31, 1904, a station was maintained at Buffalo. The records at the two points are not directly comparable, as a number of irrigation ditches divert water between and a few intermittent tributaries enter.

Drainage area.—110 square miles (measured from topographic sheets.)

Gage.—Vertical staff.

Channel.—Data too meager to determine.

Discharge measurements.—Made from bridge during high water and by wading at ordinary stages.

Winter flow.—Ice causes backwater during the winter months.

Diversions.—There are no diversions above the station and the records at this point represent the natural run-off. Below the station, however, there were adjudicated diversions amounting to 333 second-feet prior to July 1, 1912.

Accuracy.—Owing to a lack of discharge measurements no estimates of flow have been made.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

The following discharge measurement was made by H. B. Waha.

October 22, 1911: Gage height, .90 feet; discharge, 26 second-feet.

Daily gage height, in feet, of Clear Creek near Buffalo, Wyo., for 1911.

[A. Hettinger, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	.....	.....	.....	11	.....	.....	.....	21	.....	.....	.....
2	.....	.....	.....	12	.....	.90	.....	22	.95	.....	.....
3	.....	.....	.96	13	.....	.....	.....	23	.....	.....	.....
4	.....	.....	.....	14	.....	.....	.....	24	.....	.....	1.30
5	.....	.88	.....	15	.....	.....	.....	25	.....	.....	.....
6	.....	.....	.....	16	.....	.....	.....	26	.....	1.05	.....
7	.....	.....	.....	17	.....	.....	1.60	27	.....	.....	.....
8	.....	.....	.....	18	.....	.....	.....	28	.....	.....	.....
9	.....	.....	.....	19	.....	1.00	.....	29	.80	.....	.....
10	.....	.....	1.00	20	.....	.....	.....	30	.....	.....	.....
								31	.....	.....	1.00

NOTE.—Ice caused backwater Nov. 5 to Dec. 31.

CLEAR CREEK AT BUFFALO, WYO.

Location.—At concrete bridge at Buffalo, Wyo.

Records available.—May, 1896, to March 11, 1900; October 24, 1902, to November 30, 1904; May 8 to December 31, 1911. The records from May, 1896, to March 11, 1900, were obtained at a point 4 miles above Buffalo. All records since November 30, 1904, have been obtained at Buffalo.

Drainage area.—Not measured.

Gage.—Staff; set at a different datum from the gage used October 24, 1902, to November 30, 1904, but approximately the same site.

Channel.—Practically permanent; bed of stream is composed of cobblestones and firm gravel.

Discharge measurements.—Made from bridge at high stages and by wading at low stages.

Winter flow.—Gage heights affected by ice during the winter months.

Diversions.—The flow of the stream is appropriated and a large part is diverted for irrigation above the gage.

Discharge measurements of Clear Creek at Buffalo, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 8	W. A. Lamb	1.90	55
June 21	Raymond Richards	2.49	178
July 30	B. E. Jones	1.28	12.6
Sept. 9	Raymond Richards	1.22	12.8

Daily gage height, in feet, of Clear Creek at Buffalo, Wyo., for 1911.

[John H. Rice, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.8	1.4	1.3	1.25	1.2	1.15	16	2.85	3.4	1.45	1.2	1.25	1.15	.....
2	.....	3.0	1.3	1.35	1.25	1.25	1.25	17	2.65	2.85	1.75	1.25	1.2	1.2	.....
3	.....	2.55	1.2	1.35	1.2	1.2	1.15	18	2.45	.....	1.7	1.3	1.15	1.05	.....
4	.....	2.5	1.2	1.4	1.25	1.15	1.15	19	2.15	2.5	1.4	1.3	1.2	.....	.....
5	.....	2.5	1.2	1.35	1.2	1.2	1.3	20	1.95	2.55	1.55	1.25	1.15	.....	.....
6	.....	2.4	1.2	1.4	1.25	1.2	1.3	21	1.9	2.6	1.45	1.25	1.15	.....	.....
7	.....	2.35	1.1	1.4	1.2	1.25	1.3	22	1.8	2.5	1.5	1.3	1.2	.....	.....
8	1.9	2.6	1.2	1.4	1.25	1.2	1.3	23	1.8	2.3	1.55	1.25	1.15	1.15	.....
9	2.2	2.45	1.2	1.35	1.2	1.25	.....	24	1.95	2.2	1.45	1.3	1.2	1.15	.....
10	2.2	2.3	1.15	1.35	1.2	1.2	.....	25	2.2	2.0	1.4	1.25	1.15	1.2	.....
11	1.95	2.2	1.2	1.4	1.25	1.15	.....	26	2.5	1.9	1.4	1.3	1.2	1.2	.....
12	1.85	2.3	1.15	1.35	1.2	1.2	.....	27	2.4	1.75	1.3	1.25	1.15	.....	.....
13	1.9	2.7	1.2	1.3	1.25	1.15	.....	28	2.1	1.6	1.3	1.3	1.2	.....	.....
14	2.05	2.8	1.25	1.3	1.2	1.15	.....	29	1.9	1.5	.....	1.25	1.15	.....	.....
15	3.35	3.3	1.35	1.3	1.2	1.2	.....	30	1.9	1.3	1.3	1.3	1.15	.....	.....
								31	2.0	.....	1.3	1.25	.....	1.25	.....

NOTE.—Gage heights distorted by ice Nov. 5 to 8.

Daily discharge, in second-feet, of Clear Creek at Buffalo, Wyo., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	285	18	14	12	10	8.5	16	302	505	20	10	12	8.5	.....
2	.....	355	14	16	12	12	12	17	232	302	40	12	10	10	.....
3	.....	198	10	16	10	10	8.5	18	165	241	36	14	8.5	5.5	.....
4	.....	180	10	18	12	8.5	8.5	19	91	180	18	14	10	6.0	.....
5	.....	180	10	16	10	10	.....	20	60	198	26	12	8.5	7.0	.....
6	.....	150	10	18	12	10	.....	21	54	215	20	12	8.5	7.0	.....
7	.....	138	7	18	10	12	.....	22	44	180	23	14	10	8.0	.....
8	54	215	10	18	12	10	.....	23	44	125	26	12	8.5	8.5	.....
9	101	165	10	16	10	12	.....	24	60	101	20	14	10	8.5	.....
10	101	125	8.5	16	10	10	.....	25	101	63	18	12	8.5	10	.....
11	60	101	10	18	12	8.5	.....	26	180	54	18	14	10	10	.....
12	49	125	8.5	16	10	10	.....	27	150	49	14	12	8.5	10	.....
13	54	250	10	14	12	8.5	.....	28	81	29	14	14	10	10	.....
14	74	285	12	14	10	8.5	.....	29	54	23	14	12	8.5	11	.....
15	485	465	16	14	10	10	.....	30	54	14	14	14	8.5	11	.....
								31	66	.....	14	12	.....	12	.....

Monthly discharge of Clear Creek at Buffalo, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	485	44	98.9	6,080	C.
June	505	14	183	10,900	B.
July	40	7	16.1	900	B.
August	18	10	14.4	885	B.
September	12	8.5	10.1	601	B.
October	12	5.5	9.45	581	B.
November	.....	.....	[a] 8.00	476	D.
December	.....	.....	[a] 6.00	369	D.
The period	.....	.....	.....	20,900	

[a] Estimated.

NOTE.—Discharge May 1 to 7 estimated at 50 second-feet.

NOTE.—Daily discharge determined from a fairly well defined rating curve; discharge interpolated for days on which gage heights are missing.

PINEY CREEK AT KEARNEY, WYO.

Location.—At highway bridge 300 yards south of the post office at Kearney, Wyo.

Records available.—September 6, 1902, to June 30, 1906; May 13 to December 31, 1911.

Drainage area.—Not measured.

Gage.—Chain gage on highway bridge. The gage used from September 6, 1902, to June 30, 1906, was at the same site but at a different datum.

Channel.—Liable to change; bed composed of gravel and cobblestones. Current swift at high and medium stages.

Discharge measurements.—At high stages measurements are made from the bridge and at low stages by wading.

Diversions.—The greater part of the flow of this stream during the irrigation season is diverted for irrigation above the gage.

Discharge measurements of Piney Creek at Kearney, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 13	W. A. Lamb	2.10	84
June 18	R. Richards	2.05	93
July 27	B. E. Jones	1.52	20
Sept. 9	R. Richards	1.37	17.8

Daily gage height, in feet, of Piney Creek at Kearney, Wyo., for 1911.

[Mrs. R. D. Noyce, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.15	1.70	1.67	1.22	1.30	1.68	16	3.15	3.00	1.42	1.38	1.30	1.28	.....
2	.....	3.00	1.68	1.61	1.22	1.32	1.62	17	3.00	2.45	1.42	1.38	1.30	1.30	.....
3	.....	2.75	1.70	1.74	1.22	1.32	1.60	18	2.75	2.20	1.65	1.38	1.30	1.30	.....
4	.....	2.75	1.58	1.71	1.19	1.30	1.60	19	2.55	2.15	1.62	1.36	1.30	1.30	.....
5	.....	2.70	1.55	1.71	1.17	1.30	1.60	20	2.52	2.30	1.62	1.36	1.30	1.30	.....
6	.....	2.45	1.55	1.69	1.25	1.30	1.60	21	2.38	2.30	1.60	1.33	1.30	1.25	.....
7	.....	2.28	1.55	1.69	1.27	1.30	1.65	22	2.32	2.15	1.60	1.30	1.30	1.25	.....
8	.....	2.45	1.52	1.69	1.27	1.30	1.70	23	2.20	2.00	1.55	1.33	1.30	1.75	.....
9	.....	2.55	1.50	1.67	1.30	1.30	.....	24	2.40	1.95	1.50	1.33	1.30	1.65	.....
10	.....	2.20	1.50	1.54	1.30	1.25	.....	25	2.50	1.85	1.50	1.33	1.30	1.65	.....
11	.....	1.95	1.42	1.54	1.25	1.20	.....	26	2.75	1.75	1.50	1.33	1.30	1.65	.....
12	.....	2.10	1.40	1.49	1.30	1.20	.....	27	2.50	1.65	1.50	1.32	1.30	1.65	....
13	.....	2.21	1.40	1.44	1.30	1.20	.....	28	2.45	1.70	1.42	1.29	1.30	1.60	.....
14	2.40	2.28	1.40	1.40	1.30	1.20	.....	29	2.35	1.70	1.40	1.27	1.30	1.60	.....
15	3.55	2.37	1.40	1.38	1.30	1.30	.....	30	2.35	1.62	1.42	1.27	1.32	1.60	.....
								31	2.50	.....	1.58	1.22	.....	1.60	.....

Daily discharge, in second-feet, of Piney Creek at Kearney, Wyo., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	395	39	36	8.8	12	37	16	395	330	18	16	12	11	.....
2	.....	330	37	31	8.8	13	32	17	330	160	18	16	12	12	.....
3	.....	240	39	43	8.8	13	30	18	240	110	34	16	12	12	.....
4	.....	240	29	40	7.6	12	30	19	182	100	32	15	12	12	.....
5	.....	225	26	40	6.8	12	30	20	175	130	32	15	12	12	.....
6	.....	160	26	38	10	12	30	21	146	130	30	14	12	10	.....
7	.....	126	26	38	11	12	34	22	134	100	30	12	12	10	.....
8	.....	160	24	38	11	12	39	23	110	74	26	14	12	44	.....
9	.....	182	23	36	12	12	.....	24	150	68	23	14	12	34	.....
10	.....	110	23	26	12	10	.....	25	170	55	23	14	12	34	.....
11	.....	68	18	26	10	8	.....	26	240	44	23	14	12	34	.....
12	.....	90	17	22	12	8	.....	27	170	34	23	13	12	34	.....
13	.....	112	17	19	12	8	.....	28	160	39	18	12	12	30	.....
14	150	126	17	17	12	8	.....	29	140	39	17	11	12	30	.....
15	598	144	17	16	12	12	.....	30	140	32	18	11	13	30	.....
								31	170	.....	29	9	.....	30	.....

NOTE.—Daily discharge determined from a rating curve that is fairly well defined below 150 second-feet.

Monthly discharge of Piney Creek at Kearney, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May 14–31	598	110	211	7,530	C.
June	395	32	138	8,210	B.
July	39	17	21.9	1,530	B.
August	43	9	22	1,350	B.
September	13	6.8	11.2	666	B.
October	44	8	17.5	1,080	B.
November 1–8	39	30	32.8	520	B.
The period	.....	.....	.....	20,900	

LITTLE MISSOURI RIVER BASIN.

LITTLE MISSOURI RIVER NEAR ALZADA, MONT.

Location.—At Walker's ranch, 2 miles below the mouth of Thompson Creek, near the southwest corner of T. 8 N., R. 60 E., 300 yards below a proposed dam site and 4 miles below Alzada, Mont. Alzada is most conveniently reached by stage or by automobile from Belle Fourche, S. Dak.

Records available.—April 30, 1904, to November 30, 1906; June 18 to December 31, 1911.

Drainage area.—About 780 square miles.

Gage.—Vertical staff on left bank.

Channel.—May shift during high water. Stream, sluggish; banks cut 5 to 15 feet in the sandy soil.

Discharge measurements.—At ordinary stages made by wading; at flood stages must be measured by making one measurement of the Little Missouri from the bridge at Alzada and one of Thompson Creek from the bridge 2 miles above its mouth, and adding the results.

Winter flow.—Probably affected by ice.

The following discharge measurement was made by Mahon and Heidel:
June 18, 1911: Gage height, 0.6 foot; discharge estimated, 1.5 second-feet.

Daily gage height, in feet, of Little Missouri River near Alzada, Mont., for 1911.

[John Walker, observer.]

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.55	−0.25	0.6	0.45	0.55	0.7	16	.....	0.05	0.7	2.45	0.35	0.55	0.6
2	.....	.55	− .25	.6	.45	.5	.7	17	.....	.05	.6	1.25	.3	.55	.65
3	.....	.5	− .25	.55	.5	.5	.7	18	0.6	.0	.55	1.0	.3	.6	.65
4	.....	.5	− .25	.55	.5	.55	.7	19	.6	.0	3.8	.9	1.1	.65	.65
5	.....	.45	− .25	.5	.45	.6	.65	20	.5	−.05	3.95	.75	.9	.7	.65
6	.....	.4	− .25	.5	.5	.6	.6	21	.5	−.05	3.15	.7	.85	.7	.65
7	.....	.4	− .25	.7	.45	.55	.55	22	.9	−.1	1.45	.6	.8	.7	.7
8	.....	.3	2.75	.7	.45	.5	.5	23	.95	−.1	1.1	.6	.7	.7	.7
9	.....	.3	3.1	.75	.45	.55	.5	24	.8	−.15	1.0	.55	.6	.75	.7
10	.....	.3	1.45	.75	.45	.55	.6	25	.6	−.2	1.1	.55	.6	.75	.7
11	.....	.2	1.2	.9	.45	.55	.6	26	.5	−.2	1.05	.5	.6	.7	.7
12	.....	.2	.8	.8	.45	.55	.6	27	.8	−.2	.9	.45	.55	.7	.7
13	.....	.2	.6	.7	.45	.55	.6	28	.7	−.2	.75	.5	.55	.7	.7
14	.....	.1	1.0	1.6	.4	.55	.6	29	.7	−.2	.65	.5	.55	.7	.7
15	.....	.1	.8	2.4	.35	.55	.6	30	.6	−.25	.65	.45	.55	.7	.7
								31	.....	−.25	.65	.....	.55	.....	.7

NOTE.—Gage height Nov. 18 to Dec. 31 distorted by ice.

KNIFE RIVER BASIN.

KNIFE RIVER NEAR BRONCHO, N. DAK.

Location.—At C. D. Smith's ranch, in the SE. ¼ sec. 4, T. 142 N., R. 90 W., at the former site of the post office of Broncho; the present post office is about 6 miles from the old site. Spring Creek enters about 15 miles below the station and Elm Creek one-half mile above.

Records available.—May 29, 1903, to December 31, 1911.

Drainage area.—1,260 square miles; the drainage area at the present site is practically the same as at the original site, 2 miles farther downstream, the area at the lower point being perhaps 5 square miles greater.

Gage.—Chain, on left bank just below observer's house; datum unchanged since March 23, 1905, when the station was moved from the original site about 2 miles farther downstream.

Channel.—Practically permanent.

Discharge measurements.—At high stages made from car and cable 500 feet below gage; at low stages by wading.

Winter flow.—Affected by ice.

Accuracy.—Sufficient discharge measurements at high stages have not yet been made to satisfactorily check the rating curve.

Discharge measurements of Knife River near Broncho, N. Dak., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 8	J. W. Bliss	3.76	21
Aug. 16	E. F. Chandler	3.90	26

Daily gage height, in feet, of Knife River near Broncho, N. Dak., for 1911.

[C. D. Smith, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	3.9	3.8	4.7	4.1	3.4	3.5	3.5
2	.....	4.0	3.7	4.45	4.5	3.4	3.5	3.5
3	.....	4.0	3.7	7.6	3.9	3.5	3.5	3.5
4	.....	4.2	3.7	6.5	3.8	3.6	3.5	3.5
5	.....	4.2	3.6	7.4	3.8	3.5	4.2	3.5
6	.....	4.4	3.6	5.3	3.8	3.5	5.5	3.5
7	.....	4.4	3.6	4.7	3.8	3.5	5.1	3.5
8	.....	4.3	3.6	*4.3	3.8	5.1	5.0	3.5
9	.....	4.3	3.6	4.1	3.7	4.4	5.7	3.5
10	.....	4.3	3.6	4.0	3.6	4.7	5.8	3.5
11	.....	4.0	3.6	4.0	3.5	4.7	5.2	3.5
12	.....	3.9	3.6	4.0	3.4	4.8	4.9	3.5
13	.....	3.9	3.5	4.0	3.4	4.4	4.4	3.8
14	.....	4.2	3.5	4.0	3.3	4.4	4.1	3.7
15	.....	4.3	3.5	4.0	3.3	4.7	4.1	3.7
16	.....	4.1	3.5	3.9	3.3	.....	4.0	3.6
17	.....	3.9	3.5	3.9	3.3	4.8	3.9	3.6
18	.....	3.9	3.4	4.0	3.3	4.9	3.9	3.8
19	.....	3.9	3.4	4.0	3.3	4.4	3.8	4.0
20	5.9	3.9	3.4	3.9	3.3	3.8	3.6	4.0
21	6.0	3.9	3.4	3.7	3.3	3.7	3.6	3.8
22	6.4	3.9	3.4	3.7	3.3	3.5	3.6	3.7
23	5.2	3.8	3.5	3.7	3.3	3.5	3.6	3.6
24	5.2	3.8	3.9	4.45	3.3	3.5	3.6	3.6
25	4.8	3.8	3.9	3.75	3.3	3.5	3.6	3.6
26	4.6	3.8	3.8	3.7	3.3	3.5	3.5	3.6
27	4.5	3.9	3.7	3.7	3.3	3.5	3.5	3.6
28	4.3	3.9	3.5	3.7	3.3	3.5	3.5	3.6
29	4.3	3.8	3.5	3.6	3.3	3.5	3.5	3.6
30	4.1	3.8	3.9	3.6	3.3	3.5	3.5	3.6
31	4.0	.....	4.0	.....	3.3	3.5	.....	3.6

Daily discharge, in second-feet, of Knife River near Broncho, N. Dak., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	31	24	119	40	4	7	7
2	.....	39	18	86	82	4	7	7
3	.....	39	18	641	25	7	7	7
4	.....	58	18	411	19	10	7	7
5	.....	58	13	597	19	7	49	7
6	.....	80	13	197	19	7	230	7
7	.....	80	13	108	19	7	166	7
8	.....	69	13	59	19	166	151	7
9	.....	69	13	40	14	70	264	7
10	.....	69	13	32	10	108	282	7
11	.....	39	13	32	7	108	181	7
12	.....	31	13	32	4	122	136	7
13	.....	31	9	32	4	70	70	19
14	.....	58	9	32	2	70	40	14
15	.....	69	9	32	2	108	40	14
16	.....	48	9	25	2	115	32	10
17	.....	31	9	25	2	122	25	10
18	.....	31	6	32	2	136	25	19
19	.....	31	6	32	2	70	19	32
20	316	31	6	25	2	19	10	32
21	335	31	6	14	2	14	10	19
22	411	31	6	14	2	7	10	14
23	194	24	9	14	2	7	10	10
24	194	24	31	76	2	7	10	10
25	133	24	31	16	2	7	10	10
26	105	24	24	14	2	7	7	10
27	92	31	18	14	2	7	7	10
28	69	31	9	14	2	7	7	10
29	69	24	9	10	2	7	7	10
30	48	24	31	10	2	7	7	10
31	39	.....	39	.....	2	7	.....	10

NOTE.—Daily discharge determined from rating curves as follows: Mar. 20 to June 2, curve poorly defined; June 3 to Oct. 31 (1905 to 1910 curve), fairly well defined.

Monthly discharge of Knife River near Broncho, N. Dak., for 1911.

[Drainage area, 1,260 square miles.]

Month.	Discharge in second-feet.				Run-off		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	5.0	0.0040	0.005	307	
February	.....	.....	4.0	.0032	.003	222	
March	411	.....	83.1	.066	.08	5,110	C.
April	80	24	42.0	.033	.04	2,500	C.
May	31	6	14.8	.012	.01	910	C.
June	641	10	92.8	.074	.08	5,520	B.
July	82	2	10.2	.0081	.009	627	B.
August	166	4	45.6	.036	.04	2,800	B.
September	282	7	61.1	.048	.05	3,640	B.
October	32	7	11.5	.0091	.01	707	B.
November	.....	.....	8.0	.0064	.007	476	
December	.....	.....	5.0	.0040	.005	307	
The year	.....	.....	31.9	.025	.34	23,100	

NOTE.—Means for January, February, November, and December estimated; discharge Mar. 1 to 15 estimated at 30 second-feet.

HEART RIVER BASIN.

HEART RIVER NEAR RICHARDTON, N. DAK.

Location.—In or near sec. 21, T. 138 N., R. 92 W., about 11 miles south of Richardton, opposite the observer's house, which is 1 mile below the highway bridge at which the station was formerly maintained.

Records available.—May 18, 1903, to September 30, 1911.

Drainage area.—1,250 square miles.

Gage.—Readings in 1911, up to September 4, were obtained from a staff gage set in the margin of the channel at the ford about 30 rods above observer's house and about 1 mile below the highway bridge. This staff gage and the chain gage at the highway bridge were found to give identical readings until about May 15, when slides into the river below the highway bridge caused the gage heights at highway bridge to be worthless. On September 4, 1911, an overhanging chain gage was installed opposite the observer's house, its zero being set so that a reading of 3.3 on the rod gage 30 rods above is 23.3 on the chain gage. On account of a beaver dam below the gage, readings during October are uncertain.

Channel.—Not permanent.

Discharge measurements.—At high stages, made from bridge; at ordinary and low stages, by wading.

Winter flow.—Affected by ice.

Accuracy.—Sufficient high and medium stage measurements have not yet been made to define the upper part of the rating curve.

Discharge measurements of Heart River near Richardton, N. Dak., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 9	J. W. Bliss	[a] 3.90	29.2
Aug. 14	E. F. Chandler	3.49	2.0
Sept. 4	do	[b] 3.27 [c] 23.27	0.05

[a] Ice present. [b] From old staff gage. [c] From new chain gage.

Daily gage height, in feet, of Heart River near Richardton, N. Dak., for 1911.

[W. F. Church, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	4.1	3.8	4.0	3.8	3.3	3.3
2	.....	4.0	3.8	3.9	3.8	3.3	3.3
3	.....	4.0	3.8	3.9	3.7	3.3	3.3
4	.....	4.0	3.8	4.5	3.7	3.4	[a] 23.3
5	.....	4.0	3.7	5.4	3.6	3.4	23.35
6	.....	3.9	3.7	4.7	3.6	4.0	23.4
7	.....	3.9	3.7	4.45	3.5	3.9	23.4
8	.....	3.9	3.7	4.3	3.5	3.9	23.4
9	.....	3.9	3.7	4.1	3.5	3.8	23.65
10	4.6	3.8	3.7	4.1	3.5	3.8	23.95
11	4.7	3.9	3.7	4.0	3.5	3.7	23.82
12	4.8	3.9	3.7	4.0	3.4	3.6	24.25
13	4.8	4.0	3.7	3.9	3.4	3.6	24.28
14	4.9	4.0	3.7	3.9	3.4	3.6	24.28
15	5.0	4.1	3.7	3.9	3.4	3.6	24.18
16	5.1	4.1	3.8	3.9	3.4	3.5	24.10
17	5.2	4.0	3.8	3.8	3.4	3.5	24.00
18	5.3	4.0	3.8	3.8	3.3	3.5	24.00
19	5.7	4.0	3.8	3.8	3.3	3.5	23.95
20	5.0	3.9	3.8	3.8	3.3	3.5	23.90
21	4.9	3.9	3.8	3.8	3.3	3.4	23.85
22	4.5	3.9	3.9	3.7	3.3	3.4	23.80
23	4.5	3.9	4.0	3.7	3.3	3.4	23.72
24	4.5	3.9	3.9	3.7	3.3	3.4	23.70
25	4.5	3.9	3.9	3.7	3.3	3.4	23.70
26	4.6	3.9	3.9	3.6	3.3	3.4	23.65
27	4.6	3.9	3.9	3.6	3.3	3.4	23.65
28	4.5	3.9	3.9	3.6	3.3	3.4	23.60
29	4.5	3.9	3.8	3.5	3.3	3.3	23.60
30	4.2	3.8	3.8	4.0	3.3	3.3	23.55
31	4.1	.....	3.8	.....	3.3	3.3	.....

[a] New gage Sept. 3, 1911.

CANNONBALL RIVER BASIN.

CANNONBALL RIVER NEAR STEVENSON, N. DAK.

Location.—On the west side of the river near the south side of sec. 23, T. 133 N., R. 82 W., at M. H. Burdick's house, immediately above the ford, about 1 mile southeast of the Stevenson schoolhouse and about 5 miles above Timmer, N. Dak. This station is about 1 mile above the gage at the old Stevenson station, at which observations are still occasionally made.

Records available.—June 10, 1903, to November 30, 1908; August 9 to December 31, 1911.

Drainage area.—3,670 square miles.

Gages.—Standard chain on projecting cantilever timber; a temporary rod gage on the left bank was used until the chain gage was ready.

Channel.—Bed of stream composed of gravel and stones, in places covered with silt to the depth of 1 foot. At the rapids 600 feet below the gage the bed is of clean gravel and stones. During floods the silt may be washed away and later redeposited at some points.

Discharge measurements.—At low and medium stages made by wading at the ford 15 rods below the gage or at the riffle 55 rods below; at medium and high stages measurements may be made by use of the car and cable at the old Stevenson station, about 1 mile farther downstream. The discharge is practically the same at the two points, except that a small draw, which enters midway between the gage and the cable on the north side, carries a small flow for a few hours after a rain.

Winter flow.—Affected by ice.

Discharge measurements of Cannonball River near Stevenson, N. Dak., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 23	Joy W. Bliss	3.48	94
Aug. 9	E. F. Chandler	3.32	74
Sept. 5[a]	do	12.63	2.0
Nov. 3[a]	Geo. Ebner	12.71	1.6

[a] New gage; different datum.

Daily gage height, in feet, of Cannonball River near Stevenson, N. Dak., for 1911.

Day.	Mar.	Apr.	Aug.	Sept.	Oct.	Nov.	Dec.
1		3.03		12.6	12.6	12.7	
2		3.03		12.6	12.6	12.7	
3		3.03		12.5	12.6	12.7	
4				12.6	12.6	12.7	
5				12.7	12.6	12.7	
6				13.3	12.6	12.7	12.9
7				13.5	12.6	12.7	
8				13.3	12.6	12.7	
9			13.6	13.0	12.6	12.8	
10			13.9	12.9	12.6	12.8	
11			13.75	12.8	12.6	12.7	
12			13.45	12.75	12.7	12.8	
13			13.3	12.8	12.7	12.8	
14			13.05	12.9	13.2	12.8	
15			13.0	12.8	13.0	12.8	
16			12.9	12.85	12.9	12.8	
17			12.8	12.8	12.9	12.8	
18			12.85	12.8	12.8	12.8	
19			12.85	12.75	12.8	12.8	
20			12.85	12.7	12.8	12.8	
21			12.8	12.7	12.7	12.9	
22	3.48		12.75	12.7	12.7		
23	3.56		12.7	12.65	12.7		
24	3.30		12.75	12.6	12.7		
25	3.05		12.7	12.6	12.7		13.5
26	3.05		12.7	12.6			
27	3.05		12.65	12.6	12.7		
28	3.04		12.7	12.6	12.7		
29	3.04		12.65	12.6	12.7		
30	3.04		12.65	12.6	12.65		
31	3.04		12.65		12.6		

GRAND RIVER BASIN.

NORTH BRANCH OF GRAND RIVER AT HALEY, N. DAK.

Location.—About 20 rods south of the post office at Haley, N. Dak., near the northeast corner of sec. 36, T. 129 N., R. 100 W.

Records available.—May 17, 1908, to December 31, 1911.

Drainage area.—500 square miles.

Gage.—Staff.

Channel.—Bed of stream composed of gravel and silt.

Discharge measurements.—At high stages made from car and cable 200 feet below gage; at low stages by wading.

Winter flow.—Affected by ice.

Accuracy.—The gage heights obtained at this station are not of sufficient value to publish as the observer did not read the gage so long as there was no visible change in the flow, but recorded the same gage height day after day. However, he states that he kept close watch of the stream and that there was no perceptible change during the spring until the last of June, when it dropped suddenly about 0.2 in gage height, as he had recorded. The flow during the rest of the season after August 13, when a hydrographer visited the station, probably varied only slightly.

Discharge measurements of North Branch of Grand River at Haley, N. Dak., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 6	J. W. Bliss	1.00	2.27
Aug. 13	E. F. Chandler	0.66	0.16

GRAND RIVER NEAR WAKPALA, S. DAK.

Location.—At the new steel highway bridge 4 miles south of Wakpala, S. Dak., a station on the Chicago, Milwaukee & Puget Sound Railway, in or near sec. 8, T. 19 N., R. 29 E.

Records available.—September 9 to December 31, 1911.

Drainage area.—5,300 square miles.

Gage.—Standard chain on the foot-guard rail at the downstream side of the bridge.

Channel.—Probably shifts somewhat; bed composed of sand; current medium; banks steep.

Discharge measurements.—Made from highway bridge; at very low stages measurements may be made by wading at the ford 40 rods below the bridge.

Discharge measurements of Grand River near Wakpala, S. Dak., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Sept. 9	E. F. Chandler	2.73	11.8
Nov. 2	Geo. Ebner	2.52	2.3

WHITE RIVER BASIN.

WHITE RIVER NEAR INTERIOR, S. DAK.

Location.—At the steel highway bridge near the southwest corner of sec. 7, T. 4 S., R. 18 E., where the county line between Stanley and Pennington counties intersects White River, 3 miles southwest of Interior, S. Dak., a station on the Chicago, Milwaukee & St. Paul Railway.

Records available.—June 24, 1904, to November 30, 1906, at old station in T. 3 S., R. 18 E.; August 24 to November 30, 1911.

Drainage area.—4,090 square miles. The area above the present site is about 15 square miles less than the area above the station maintained during 1904–1906 near Westover.

Gage.—A vertical rod attached to the lower side of the first pier (nearest the shore) at the left end of the bridge, installed August 31, 1911, and supposed to read the same as the temporary rod gage which was placed August 24 on a tree on the left bank at the turn of the river near the southwest corner of NW. ¼ sec. 17.

Channel.—Probably changes gradually; bed composed of sand and some quicksand; left bank steep and clean; right bank gently sloping and clean; current, medium. At low stages all the water may pass under one span (67-foot); at the highest stage the water passes under two 67-foot spans and 120 feet of trestle approach, but probably two-thirds of the flow passes under the two spans.

Discharge measurements.—Made from the highway bridge.

Discharge measurements of White River near Interior, S. Dak., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 24	E. F. Chandler	10.46	5,548
31	do	3.66	38.3
Nov. 10	Gorie Monley	3.75	93

Daily gage height, in feet, of White River near Interior, S. Dak., for 1911.

[D. M. Waller, observer.]

Day.	Aug.	Sept.	Oct.	Nov.	Day.	Aug.	Sept.	Oct.	Nov.
1		3.65	4.7	4.1	16		5.2	5.6	4.1
2		3.65	4.65	4.0	17		5.15	5.1	4.6
3		3.7	4.0	5.8	18		5.05	4.3	4.75
4		3.75	4.5	5.7	19		5.0	4.5	4.8
5		3.8	4.7	5.6	20		4.9	5.5	4.9
6		9.2	4.7	5.55	21		4.7	4.8	5.0
7		7.0	4.7	4.0	22		4.65	4.65	5.3
8		7.5	4.65	4.0	23		4.7	4.5	5.2
9		6.4	4.65	4.05	24	10.5	4.85	4.4	4.8
10		6.35	4.7	4.1	25	8.2	4.8	4.4	4.7
11		6.0	4.7	4.1	26	5.2	4.75	4.1	4.75
12		5.6	4.7	4.1	27	3.9	4.7	5.4	4.8
13		5.45	4.75	4.1	28	3.7	4.8	4.0	5.0
14		5.3	4.75	4.1	29	3.7	4.75	4.1	4.8
15		5.25	4.9	4.1	30	3.65	4.7	4.15	4.7
					31	3.65		4.2	

WHITE RIVER AT WESTOVER, S. DAK.

Location.—Near the east side of sec. 32, T. 3 S., R. 29 E., 12 miles south and slightly east from Murdo, S. Dak., a station on the Chicago, Milwaukee & St. Paul Railway; about 1 mile below the entrance of Little White River.

Records available.—August 25 to December 31, 1911.

Drainage area.—7,850 square miles.

Gage.—A series of vertical rods. When the bridge is completed a permanent rod or chain gage will be placed.

Channel.—Likely to scour and fill in flood seasons; bed composed of sand and quicksand with some gravel and stones.

Discharge measurements.—At low stages made by wading at the ford near the gage; at higher stages by the use of the ferry cable and a boat.

Winter flow.—Affected by ice.

Discharge measurements of White River at Westover, S. Dak., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 25	E. F. Chandler	11.59	7,370
30	do	8.52	397
Nov. 8	Gorie Monley	8.35	135

NIOBRARA RIVER BASIN.

NIOBRARA RIVER AT NIOBRARA, NEBR.

Location.—At the Government highway bridge spanning the main channel in the SE. ¼ sec. 18, T. 32 N., R. 56 W., half a mile from the depot at Niobrara. The station is 1½ miles above the mouth. No tributaries enter below.

Records available.—August 19, 1910, to October 5, 1911. From May 11 to October 25, 1902, a station was maintained at a highway bridge 1 mile southwest of Niobrara.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Shifting and within the influence of backwater from Missouri River.

Discharge measurements.—Made from bridge.

Winter flow.—During the winter months ice causes backwater for short periods.

Diversions.—Prior to September 1, 1912, there were approved diversions of 561 second-feet for irrigation and 2,755 second-feet for power from Niobrara River above the station. There were also approved diversions of 180 second-feet for irrigation and 453 second-feet for power from tributaries entering above. In Wyoming there are adjudicated diversions of 24 second-feet from the Niobrara and tributaries.

Accuracy.—Owing to the shifting channel and insufficient discharge measurements, no estimates of discharge have been made.

Cooperation.—Station maintained in cooperation with the State engineer, by whom the field data are furnished.

Discharge measurements of Niobrara River at Niobrara, Nebr., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 31	A. A. Dobson	0.85	2,240	Aug. 4	A. B. Price	1.50	1,080
Apr. 26	A. B. Price	1.30	1,860	26	do	1.50	1,150
May 27	do	1.40	1,960	Sept. 25	do	1.40	1,100
June 22	do	1.40	1,140	Oct. 5	do	1.30	1,210

Daily gage height, in feet, of Niobrara River at Niobrara, Nebr., for 1911.

[A. F. Reid, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.9	1.8	1.4	.....	1.3	1.2	1.3	16	.....	1.6	1.4	1.3	1.4	1.5	1.5
2	1.0	1.6	1.3	1.1	1.3	1.3	1.4	17	.....	1.0	1.4	1.3	1.4	1.4	1.4
3	1.1	1.6	1.3	1.1	1.4	1.3	1.3	18	.....	.9	1.5	1.5	1.4	1.5	1.4
4	1.1	1.6	1.2	1.2	1.5	1.5	.....	19	.....	.9	1.4	1.5	1.5	1.6	1.5
5	1.2	1.5	1.3	1.3	1.5	1.5	1.3	20	.....	1.0	1.3	1.5	1.5	1.6	1.3
6	1.3	1.5	1.3	1.3	1.5	1.6	.....	21	.....	1.2	1.3	1.5	1.4	1.5	1.4
7	1.1	1.5	1.4	1.2	1.6	1.5	.....	22	.....	1.2	1.5	1.4	1.4	1.4	1.4
8	1.1	1.5	1.4	1.2	1.6	1.5	.....	23	.....	1.2	1.5	1.4	1.4	1.5	1.4
9	1.0	1.5	1.3	1.4	1.7	1.4	.....	24	.....	1.2	1.4	1.3	1.5	1.5	1.4
10	.8	1.5	1.3	1.2	1.6	1.4	.....	25	.....	1.2	1.4	1.3	1.5	1.6	1.3
11	.9	1.4	1.3	1.2	1.6	1.4	.....	26	.....	1.3	1.4	1.4	1.5	1.5	1.4
12	.9	1.4	1.2	1.3	1.6	1.4	.....	27	.....	1.2	1.4	1.6	1.4	1.4	1.4
13	.9	1.4	1.2	1.3	1.5	1.3	.....	28	.....	1.2	1.3	1.4	1.3	1.5	1.4
14	.9	1.5	1.3	1.3	1.5	1.4	.....	29	.....	1.2	1.4	1.2	1.3	1.5	1.4
15	.8	1.4	1.4	1.4	1.5	1.4	.....	30	.....	1.4	1.2	1.0	1.3	1.4	1.3
								31	0.85	.....	1.2	1.0	1.3	1.4	.....

BIG SIOUX RIVER BASIN.

ROCK RIVER AT LUVERNE, MINN.

Location.—At the Rock Island Railroad bridge at Luverne, Minn., 3½ miles above the mouth of Elk Creek.

Records available.—August 23, 1911, to December 31, 1911.

Drainage area.—440 square miles.

Gage.—Vertical staff.

Channel.—Probably permanent; small rapids just below gage; severe floods will cause a change.

Discharge measurements.—Made from the railroad bridge at flood stage, from the highway bridge at medium stage, and at a wading section in low water.

Winter flow.—From December to March the river is frozen over at the station and measurements are made through the ice to determine the winter discharge.

Artificial control.—The flow of the river is not artificially controlled above Luverne, as there are no dams except a low rock dam a short distance above the station, which does not regulate the flow but simply raises the water level about 2 feet.

Cooperation.—Station maintained in cooperation with the State Drainage Commission.

Discharge measurements of Rock River at Luverne, Minn., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 23	Robert Follansbee	1.64	16.6
Sept. 23	S. B. Soulé	2.15	[a] 53.9
Dec. 10	C. J. Emerson	1.95	[b] 37

[a] Discharge does not include overflow channel, estimated flow about 10 second-feet.
[b] Overflow channel overlooked—may have been some flow.

Daily gage height, in feet, and discharge, in second-feet, of Rock River at Luverne, Minn., for 1911.

[C. W. Pinkerton, observer.]

Day.	Aug.		Sept.		Oct.		Nov.		Dec.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			1.5	13	1.9	32	2.40	81		
2			1.5	13	1.9	32	2.35	75		
3			1.5	13	1.9	32	2.30	69		
4			3.3	211	2.0	40	2.38	79	1.90	
5			2.75	130	2.2	58	2.32	71		
6			2.4	81	6.6	976	2.35	75		
7			2.0	40	7.0	1,080	2.40	81	1.90	
8			1.9	32	6.35	911	2.45	88		
9			1.9	32	5.4	667	2.50	95		
10			3.25	203	4.5	456	2.42	84	1.94	
11			3.5	246	3.8	303	2.35	75	1.92	
12			3.1	180	3.3	211	2.10	48	1.92	
13			2.45	88	3.5	246	2.30	69	1.90	
14			2.2	58	4.0	346	2.20	58	1.90	
15			2.1	48	3.5	246	2.15	53	1.92	
16			1.9	32	3.7	283	2.10	48	1.82	
17			1.9	32	4.9	547	2.05	44		
18			2.6	109	5.4	667	2.02	42	1.82	
19			2.9	151	5.2	618	2.00	40		
20			3.0	165	4.5	456	2.00	40		
21			2.9	151	4.0	346	2.00	40	1.80	
22			2.4	81	3.5	246	2.00	40		
23	1.6	16	2.2	58	3.2	195	1.90	32		
24	1.6	16	2.0	40	3.1	180	1.95			
25	1.6	16	2.0	40	2.95	158	1.90		1.80	
26	1.6	16	1.9	32	2.88	148	1.95			
27	1.6	16	1.9	32	2.8	137	1.95			
28	1.6	16	1.9	32	2.75	130			1.80	
29	1.6	16	1.8	25	2.7	123				
30	1.6	16	1.8	25	2.62	112	1.90			
31	1.5	13			2.6	109				

NOTE.—Relation of gage height to discharge affected by ice about Nov. 24 to Dec. 31. Daily discharge computed from a rating curve well defined between 16 and 346 second-feet (gage heights 1.6 and 4 feet). Discharge Nov. 25 to Dec. 31 estimated, because of ice, from observer's notes, climatologic records, and one discharge measurement; mean discharge Nov. 24 to 30 estimated 26 second-feet, varying from about 30 to 24 second-feet; mean discharge Dec. 1 to 31 estimated 23 second-feet, varying from about 37 to 10 second-feet.

Monthly discharge of Rock River at Luverne, Minn., for 1911.

[Drainage area, 440 square miles.]

Month.	Discharge in second-feet.				Run-off (depth in inches on drainage area).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
August 23-31	16	13	15.7	0.036	0.01	B.
September	246	13	79.8	.181	.20	B.
October	1,080	32	326	.741	.85	B.
November	95		[a] 53.6	.122	.14	C.
December			[b] 23	.052	.06	D.

[a] Partially estimated. [b] Estimated.

NOTE.—See footnotes to table of daily discharge.

PLATTE RIVER BASIN.

NORTH PLATTE RIVER AT SARATOGA, WYO.

Location.—At highway bridge in Saratoga, 2 miles below the mouth of Spring Creek.

Records available.—June 9, 1903, to October 31, 1906; April 1 to December 17, 1909; April 27 to November 10, 1911.

Drainage area.—2,920 square miles. Measured from Land Office maps.

Gage.—A chain gage was installed at the bridge in 1911. The original gage was a vertical staff located 100 yards below the bridge. The relation between the two gages has not been determined.

Channel.—Practically permanent, except that tie drives may cause backwater for a few days.

Discharge measurements.—Made from bridge.

Winter flow.—Ice causes backwater during the winter months, and the records are discontinued.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions of 86 second-feet, from the North Platte above Saratoga, in Wyoming, and 934 second-feet from tributaries entering above. In the Colorado portion of the drainage area there are adjudicated decrees for diversions of 3,060 second-feet from the headwaters of the North Platte.

Accuracy.—Conditions are favorable for accurate results and the estimates should be reliable.

Cooperation.—Station maintained in cooperation with the State engineer.

Discharge measurements of North Platte River at Saratoga, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 25	Fletcher and Kingdon	5.00	1,560	June 10	R. H. Fletcher	7.69	6,780
May 4	do	5.15	1,640	19	do	7.22	5,710
29	R. H. Fletcher	6.40	4,090	July 10	do	5.10	1,440
June 1	do	7.04	5,280	Oct. 5	G. H. Russell	4.57	795

Daily gage height, in feet, of North Platte River at Saratoga, Wyo., for 1911.

[Garrett Price, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	5.5	6.9	5.3	4.21	3.73	4.31	4.0
2	.....	5.25	7.6	5.3	4.16	3.73	4.31	3.9
3	.....	5.2	7.3	5.45	4.11	3.73	4.41	3.85
4	.....	5.15	7.4	5.6	4.01	3.79	4.31	3.85
5	.....	5.3	7.4	5.5	3.96	3.81	4.30	4.0
6	.....	5.8	7.3	5.35	3.96	3.81	4.95	3.95
7	.....	6.0	7.3	5.35	4.01	3.71	4.8	3.65
8	.....	6.4	[a] 7.6	5.4	3.99	3.73	4.6	3.8
9	.....	6.8	7.8	5.2	3.81	3.73	4.45	3.95
10	.....	6.8	7.4	5.15	3.79	3.69	4.4	4.0
11	.....	6.5	7.3	4.96	3.71	3.69	4.35	.....
12	.....	6.4	7.2	4.79	3.73	3.66	4.2	.....
13	.....	6.2	7.2	4.71	3.79	3.66	4.15	.....
14	.....	6.3	7.3	4.71	3.79	3.69	4.1	.....
15	.....	6.7	7.2	4.71	3.73	3.66	4.1	.....
16	.....	6.8	7.4	4.61	3.71	3.66	4.1	.....
17	.....	6.9	8.0	4.76	3.73	3.73	4.1	.....
18	.....	6.8	7.8	4.73	3.86	3.61	4.1	.....
19	.....	6.7	7.4	4.71	3.89	3.66	4.15	.....
20	.....	6.5	7.3	4.79	3.89	3.66	4.05	.....
21	.....	6.4	7.4	4.79	3.91	3.63	3.8	.....
22	.....	6.3	7.4	4.73	3.93	3.61	3.85	.....
23	.....	6.1	7.0	4.76	4.09	3.63	4.0	.....
24	.....	6.3	6.5	4.76	4.11	3.66	4.15	.....
25	5.0	6.4	6.4	4.69	4.11	3.71	4.1	.....
26	5.2	6.8	6.2	4.53	4.06	3.81	4.1	.....
27	5.4	6.6	5.2	4.46	4.01	3.86	4.1	.....
28	5.5	6.4	5.8	4.41	3.91	3.81	4.0	.....
29	5.6	6.4	5.45	4.43	3.86	3.91	4.05	.....
30	5.6	6.6	5.45	4.33	3.81	4.01	4.05	.....
31	.....	6.8	.....	4.23	3.83	.....	4.05	.....

[a] Maximum stage reached during this flood was at a gage height of 11 feet.

Daily discharge, in second-feet, of North Platte River at Saratoga, Wyo., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2,240	5,040	1,890	478	208	559	340
2	.....	1,800	6,570	1,890	442	208	559	286
3	.....	1,720	5,910	2,150	407	208	650	262
4	.....	1,630	6,130	2,420	346	234	559	262
5	.....	1,890	6,130	2,240	318	243	550	340
6	.....	2,800	5,910	1,980	318	243	1,320	313
7	.....	3,180	5,910	1,980	346	200	1,100	178
8	.....	3,990	6,570	2,060	335	208	850	238
9	.....	4,830	7,030	1,720	243	208	690	313
10	.....	4,830	6,130	1,640	234	192	640	340
11	.....	4,200	5,910	1,330	200	192	595	.....
12	.....	3,990	5,690	1,090	208	182	470	.....
13	.....	3,580	5,690	983	234	182	435	.....
14	.....	3,780	5,910	983	234	192	400	.....
15	.....	4,620	5,690	983	208	182	400	.....
16	.....	4,830	6,130	862	200	182	400	.....
17	.....	5,040	7,490	1,050	208	208	400	.....
18	.....	4,830	7,030	1,010	267	164	400	.....
19	.....	4,620	6,130	983	281	182	435	.....
20	.....	4,200	5,910	1,090	281	182	370	.....
21	.....	3,990	6,130	1,090	291	171	238	.....
22	.....	3,780	6,130	1,010	302	164	262	.....
23	.....	3,380	5,250	1,050	394	171	340	.....
24	.....	3,780	4,200	1,050	407	182	435	.....
25	1,300	3,990	3,990	958	407	200	400	.....
26	1,720	4,830	3,580	773	376	243	400	.....
27	2,060	4,410	1,720	700	346	267	400	.....
28	2,240	3,990	2,800	650	291	243	340	.....
29	2,420	3,990	2,150	670	267	291	370	.....
30	2,420	4,410	2,150	577	243	346	370	.....
31	.....	4,830	.....	494	252	.....	370	.....

NOTE.—Daily discharge determined from a rating curve that is fairly well defined above 750 second-feet.

Monthly discharge of North Platte River at Saratoga, Wyo., for 1911.

[Drainage area, 2,920 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
April 25-30	2,420	1,300	2,030	0.695	0.16	24,200	B.
May	5,040	1,630	3,810	1.30	1.50	234,000	B.
June	7,490	1,720	5,370	1.84	2.05	320,000	B.
July	2,420	494	1,270	.435	.50	78,100	B.
August	478	200	302	.103	.12	18,600	C.
September	346	164	209	.072	.08	12,400	C.
October	1,320	238	507	.174	.20	31,200	C.
November 1-10	340	178	287	.098	.04	5,690	C.
The period						724,000	

NORTH PLATTE RIVER AT PATHFINDER, WYO.

Location.—Half a mile south of Pathfinder, 800 feet below the mouth of the canyon, in sec. 24, T. 29 N., R. 84 W. The nearest tributary is Canyon Creek, which enters 2 miles above.

Records available.—May 9, 1905, to December 3, 1911.

Drainage area.—About 12,000 square miles.

Gage.—Chain gage; datum unchanged.

Channel.—Condition not known, as only final results are furnished.

Discharge measurements.—Made from car and cable.

Winter flow.—Ice causes slight backwater for short periods.

Controlled flow.—The Pathfinder dam, one-fourth mile above the station, forms a reservoir of 1,025,000 acre-feet capacity. This reservoir materially changes the natural run-off of the river, as is seen by a comparison with the records of inflow.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions of 58 second-feet from the North Platte between Saratoga and Pathfinder, and 1,550 second-feet from intervening tributaries. Near Whalen, 150 miles below, the water from the Pathfinder reservoir is diverted by the interstate canal and used to irrigate land in Nebraska and Wyoming. Further canals are contemplated by the Reclamation Service.

Cooperation.—Station maintained in cooperation with United States Reclamation Service, by which the records are furnished.

The following discharge measurement was made by H. D. Comstock:

May 25, 1911: Gage height, 3.40 feet; discharge, 1,640 second-feet.

Daily gage height, in feet, of North Platte River at Pathfinder, Wyo., for 1911.

[United States Reclamation Service Engineers, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.25	2.3	1.6	2.1	4.0	4.8	5.45	4.7	3.9	1.6	2.05	1.4
2	1.25	2.5	1.6	3.05	4.05	4.2	5.2	4.65	3.9	2.3	2.0	1.4
3	1.25	2.55	1.6	3.05	2.1	4.2	5.2	4.65	3.9	3.0	1.9	1.4
4	1.25	2.1	1.6	2.8	2.1	4.25	5.2	4.65	3.9	2.9	2.0	1.45
5	1.25	2.55	1.6	2.8	2.15	4.3	5.2	4.65	3.9	2.8	2.0	1.5
6	1.25	2.2	2.0	4.05	2.2	4.1	5.2	4.65	3.85	2.8	2.0	1.55
7	1.2	2.3	2.6	3.2	2.2	4.3	5.2	4.65	3.85	2.6	1.9	1.55
8	1.2	2.2	2.95	3.2	2.25	4.2	5.2	4.65	3.8	3.3	1.9	1.5
9	1.15	2.2	3.1	3.2	2.25	4.2	4.95	4.6	3.8	3.3	1.9	1.5
10	2.3	2.2	3.2	3.2	2.3	4.65	4.95	4.6	3.8	2.2	1.8	1.5
11	1.15	2.1	3.3	3.2	2.3	4.65	4.95	4.6	3.8	2.3	1.6	1.5
12	2.1	2.15	3.4	3.2	2.3	4.7	5.0	4.6	4.25	2.3	1.4	1.5
13	1.4	2.1	3.4	3.2	2.4	5.05	5.0	4.55	4.2	2.35	1.0	1.4
14	1.6	2.05	3.4	3.2	3.65	5.4	4.75	4.55	4.15	2.35	1.15	1.4
15	1.5	2.0	5.1	3.6	3.65	5.75	4.75	4.55	4.15	2.3	1.3	1.3
16	1.4	1.8	5.3	3.6	3.65	5.75	4.75	4.5	4.1	2.35	1.5	1.3
17	1.35	2.2	4.0	3.55	3.7	5.2	4.75	4.5	4.15	2.35	1.65	1.4
18	2.25	2.2	3.0	3.5	3.5	5.15	4.75	4.5	4.1	2.3	1.8	1.4
19	2.2	2.15	1.7	4.0	3.5	5.15	4.75	4.5	4.2	2.25	1.9	1.4
20	1.3	1.8	1.8	4.0	3.45	5.1	4.75	4.45	4.15	2.2	2.0	1.4
21	1.5	2.3	1.9	3.95	3.5	4.85	4.7	4.45	4.15	2.2	2.1	1.35
22	1.9	2.7	1.95	3.9	3.4	5.25	4.7	4.4	4.2	2.15	2.1	1.3
23	2.4	1.8	2.0	3.75	3.4	5.3	4.7	4.4	4.55	2.15	2.1	1.2
24	2.4	1.9	2.0	3.9	3.4	5.3	4.7	4.35	4.45	2.1	2.1	1.25
25	1.4	1.7	2.05	4.15	3.4	5.3	4.7	4.35	4.55	2.0	2.05	1.2
26	1.4	1.8	2.1	4.15	3.4	5.3	4.7	4.35	4.50	2.0	2.0	1.2
27	1.6	1.9	2.1	4.15	3.4	2.0	4.7	4.0	4.3	2.1	2.0	1.2
28	1.5	1.55	2.1	4.1	3.6	2.0	4.7	4.0	1.5	2.1	1.8	1.15
29	1.6	.....	2.1	4.0	3.9	5.0	4.7	3.95	1.6	2.1	1.6	1.2
30	1.7	.....	2.1	4.1	4.2	5.45	4.7	3.95	1.9	2.1	1.4	1.1
31	1.9	.....	2.1	.....	4.2	.....	4.7	3.9	.....	2.1	.....	1.15

NOTE.—Ice present Jan. 23 and 24, Feb. 17 to 27, and Dec. 15 to 27.

Daily discharge, in second-feet, of North Platte River at Pathfinder, Wyo., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	294	760	438	661	2,250	3,200	3,730	3,070	2,140	188	650	354
2	294	880	438	1,220	2,305	2,470	3,890	3,005	2,140	1,320	626	354
3	294	915	438	1,300	1,210	2,470	3,750	3,005	2,140	755	592	354
4	294	661	438	1,095	661	2,525	3,750	3,005	2,140	1,125	592	364
5	294	915	438	1,095	685	2,580	3,750	3,005	2,140	1,095	615	385
6	294	710	615	1,900	710	2,360	3,700	3,005	2,085	1,095	615	406
7	276	760	950	1,765	710	2,580	3,750	3,005	2,085	1,020	592	417
8	276	710	1,215	1,435	735	2,470	3,750	3,005	2,030	1,237	569	406
9	259	710	1,345	1,435	735	2,470	3,470	2,940	2,030	1,525	569	396
10	760	710	1,435	1,435	760	2,900	3,400	2,940	2,030	770	547	396
11	259	661	1,525	1,435	760	3,005	3,400	2,940	2,030	735	481	396
12	661	685	1,615	1,435	760	3,070	3,450	2,940	2,480	760	396	396
13	354	661	1,615	1,435	820	3,310	3,450	2,880	2,470	790	284	375
14	438	638	1,615	1,435	1,720	3,810	3,450	2,880	2,415	790	237	354
15	396	615	2,740	1,755	1,865	4,530	3,160	2,880	2,415	775	286	333
16	354	525	3,940	1,815	1,865	4,645	3,135	2,820	2,360	775	354	313
17	333	610	3,290	1,790	1,920	4,230	3,135	2,820	2,415	790	427	333
18	735	560	1,400	1,740	1,715	3,730	3,135	2,820	2,360	775	492	354
19	710	560	675	2,680	1,715	3,680	3,135	2,820	2,470	748	547	354
20	313	500	525	2,250	1,665	3,650	3,135	2,760	2,415	722	592	354
21	396	500	569	2,220	1,715	3,160	3,070	2,760	2,415	710	638	344
22	569	500	592	2,170	1,615	3,530	3,070	2,700	2,470	698	661	323
23	720	450	615	2,060	1,615	3,860	3,070	2,700	2,710	685	661	294
24	720	569	615	1,945	1,615	3,900	3,070	2,640	2,760	673	661	285
25	354	481	638	2,270	1,615	3,900	3,070	2,640	2,880	638	650	285
26	354	525	661	2,430	1,615	3,900	3,070	2,640	2,880	615	626	276
27	438	450	661	2,420	1,615	890	3,070	2,250	2,800	638	615	276
28	396	300	661	2,360	1,855	615	3,070	2,250	1,800	661	570	268
29	438	.....	661	2,250	2,140	3,440	3,070	2,195	438	661	481	268
30	481	.....	661	2,360	2,470	4,110	3,070	2,195	569	661	396	243
31	569	.....	661	.....	2,500	.....	3,070	2,140	.....	661	.....	243

NOTE.—Daily discharge represents the outflow from the Pathfinder reservoir.

Monthly discharge of North Platte River at Pathfinder, Wyo., for 1911.

[Drainage area, 12,000 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
January	760	259	430	0.036	0.04	26,400
February	915	300	626	.052	.05	34,800
March	3,940	438	1,090	.091	.105	66,800
April	2,430	661	1,770	.147	.16	105,000
May	2,500	661	1,480	.124	.14	91,100
June	4,640	615	3,170	.264	.29	188,400
July	3,890	3,070	3,330	.278	.32	205,000
August	3,070	2,140	2,760	.230	.26	170,000
September	2,880	438	2,220	.185	.21	132,000
October	1,520	188	809	.067	.08	49,700
November	661	237	534	.044	.05	31,800
December	417	243	339	.028	.03	20,800
The year	4,640	188	1,550	.13	1.75	1,120,000

NOTE.—Table shows outflow from Pathfinder reservoir.

Daily inflow, in second-feet, to Pathfinder reservoir at Pathfinder, Wyo., for 1911.

[United States Reclamation Service engineers, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	334	1,085	554	1,260	3,150	5,200	2,380	570	398	760	560	354
2	334	930	438	1,230	3,180	5,950	2,070	525	428	760	510	354
3	334	865	438	1,120	3,080	6,060	1,950	548	359	900	435	354
4	334	479	443	1,770	2,800	6,840	2,200	576	294	1,030	642	406
5	334	1,066	492	2,000	2,490	6,700	2,200	526	318	1,095	681	385
6	334	544	685	3,300	2,500	6,600	2,400	412	302	1,260	615	502
7	316	785	1,320	2,100	2,210	6,900	2,220	353	246	894	380	417
8	316	780	2,320	2,670	3,080	7,040	2,240	422	226	1,870	614	310
9	299	760	2,000	1,820	4,100	7,530	2,190	420	256	1,440	569	396
10	400	760	2,500	1,815	5,150	8,090	1,890	485	397	1,350	501	396
11	459	611	3,200	1,450	5,320	9,080	1,680	633	337	1,350	356	492
12	461	670	2,770	1,450	5,600	8,570	1,310	646	378	948	209	300
13	354	616	2,540	1,450	5,410	6,920	945	415	438	1,010	128	375
14	438	658	2,250	1,360	4,270	6,700	955	488	688	795	277	354
15	396	596	1,180	1,050	4,500	6,630	1,010	342	681	684	372	290
16	354	490	763	872	4,780	7,180	1,010	357	378	664	384	313
17	333	610	307	1,070	5,320	7,230	810	377	250	650	523	375
18	735	520	1,250	1,210	5,660	10,140	830	440	250	645	532	354
19	710	555	1,410	610	6,290	10,740	870	474	250	653	668	354
20	313	475	1,620	791	6,230	9,100	890	613	250	644	804	354
21	396	500	1,360	731	5,770	8,690	1,070	542	250	660	885	302
22	569	500	1,080	978	4,800	6,830	1,070	457	250	608	793	323
23	720	430	1,490	1,180	4,840	7,160	1,090	506	250	530	661	294
24	720	619	1,440	1,450	4,410	6,780	1,110	441	250	618	566	267
25	354	502	1,700	1,690	3,700	6,340	1,140	484	250	562	615	285
26	354	540	1,520	1,820	3,720	5,430	750	524	250	558	626	276
27	438	385	1,460	1,960	4,250	4,320	810	429	250	695	408	276
28	416	234	1,240	1,970	3,770	3,610	840	447	250	661	318	212
29	460	.....	785	2,200	3,810	4,030	839	451	271	661	315	268
30	530	.....	731	2,740	4,140	2,750	478	401	576	661	258	243
31	613	.....	1,220	.....	5,560	.....	527	430	.....	661	.....	243

Monthly inflow to Pathfinder reservoir at Pathfinder, Wyo., for 1911.

[Drainage area, 12,000 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
January	735	313	434	0.036	0.04	26,700
February	1,080	234	627	.052	.05	34,800
March	3,200	307	1,370	.114	.13	84,300
April	3,300	610	1,570	.131	.15	93,500
May	6,290	2,210	4,320	.360	.42	266,000
June	10,700	2,750	6,840	.570	.64	407,000
July	2,400	478	1,350	.112	.13	82,900
August	646	342	475	.040	.05	29,200
September	688	226	332	.028	.03	19,800
October	1,870	530	850	.071	.08	52,200
November	885	128	507	.042	.05	30,200
December	502	212	336	.028	.03	20,700
The year	10,700	128	1,580	.132	1.79	1,150,000

NORTH PLATTE RIVER AND INTERSTATE CANAL AT WHALEN, WYO.

Location.—At the head of the Interstate canal at Whalen, in sec. 11, T. 26 N., R. 65 W. The nearest important tributary is Cottonwood Canyon Creek, an intermittent stream which enters 1½ miles below.

Records available.—May 1, 1909, to December 31, 1911. These records represent the discharge passing the overfall weir at Whalen and also the amount of water passing the head gates of the canal, which are located just above the Whalen weir. From June 14, 1900, to November 17, 1908, a station was maintained at Guernsey. The flow between the two points is very nearly comparable, as only a few intermittent tributaries enter between the two points.

Drainage area.—Not measured.

Gage.—To determine the flow over the weir a vertical staff is used, its zero being at the weir crest. The discharge is then computed by a weir formula. There are also four sluice gates in the dam, through which the discharge is computed. There is also a second gage in the river 75 feet downstream from the crest gage, having its zero 10.00 feet below that of the weir gage. This latter gage is only used in computing the discharge through the gates when the openings are submerged. The discharge through the head gates of the canal is computed from the nine gate openings. There is a vertical staff located in the canal 1,000 feet below the head gates, which is used in computing the discharge when the head-gate openings are submerged.

Discharge measurements.—In order to check the coefficients used in the discharge computations, a car and cable have been erected 1 mile downstream. Sufficient measurements have not yet been made to complete the checking.

Artificial control.—The discharge represents largely the effect of the Pathfinder reservoir which stores water for use in the Interstate canal.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions from North Platte River of 319 second-feet between Pathfinder reservoir and the Wyoming-Nebraska line, exclusive of the diversion by the United States Reclamation Service. It is not known what percentage of these diversions is above the stations.

Cooperation.—Station maintained by the United States Reclamation Service, by which the records are furnished.

Discharge measurements of North Platte River and Interstate canal at Whalen, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 8	Paul Rothi	2.09	721	Apr. 28	Paul Rothi	2.71	1,390
11	do	2.02	686	May 4	do	3.63	2,550
18	do	2.19	828	30	do	1.82	533
22	do	2.60	1,330	June 17	do	4.71	4,760
25	do	2.60	1,212	Sept. 19	do	2.55	1,180

Daily discharge, in second-feet, of North Platte River and Interstate canal at Whalen, Wyo., for 1911.

[United States Reclamation Service engineers, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	250	1,871	667	808	2,722	2,456	1,774	2,848	2,177	2,000	835	239
2	170	1,919	615	771	2,838	2,650	3,682	2,848	2,119	1,269	646	249
3	160	1,273	601	802	2,838	2,322	3,523	2,868	2,115	1,012	646	593
4	175	1,206	642	893	2,838	2,598	3,626	2,883	2,115	879	730	539
5	578	1,022	607	1,287	2,872	2,309	3,474	2,883	2,058	954	835	648
6	521	1,140	622	1,626	2,142	2,182	3,474	2,883	2,058	1,163	950	606
7	521	916	697	1,494	1,637	2,309	3,474	3,245	2,006	1,290	835	556
8	521	1,079	774	1,313	1,636	2,329	3,425	3,179	1,978	1,247	835	556
9	521	911	1,311	2,025	1,427	2,282	3,425	2,883	2,005	1,218	835	556
10	521	713	1,224	1,697	1,499	2,417	3,425	2,798	2,008	1,218	835	556
11	521	741	1,409	1,580	1,486	2,347	3,327	2,798	1,963	1,147	362	498
12	575	821	1,407	1,568	1,601	2,486	3,248	2,798	1,981	1,533	280	498
13	519	783	1,467	1,598	1,601	2,718	3,275	2,797	1,976	1,216	308	498
14	759	961	1,512	1,598	1,484	2,729	3,202	2,756	2,070	781	340	498
15	820	1,040	1,552	1,607	1,323	2,943	3,212	2,791	2,280	833	386	498
16	[a]1,296	918	1,599	1,584	1,265	4,384	3,244	2,791	2,295	1,079	448	498
17	[a]1,260	945	1,763	1,559	1,803	5,872	3,585	2,709	2,294	1,079	448	498
18	810	901	3,479	1,821	2,011	5,766	3,585	2,709	2,218	1,014	481	498
19	765	682	3,469	1,849	2,011	4,796	3,585	2,709	2,218	950	656	498
20	675	339	2,416	1,696	1,953	4,181	3,513	2,745	2,294	950	765	498
21	525	259	1,714	1,682	1,961	4,073	3,567	2,745	2,294	950	823	441
22	525	234	1,289	2,127	1,965	3,965	3,426	2,745	2,294	950	1,093	441
23	470	157	952	2,100	1,936	3,425	3,308	2,745	2,294	950	1,093	441
24	470	375	952	2,100	1,942	3,658	3,012	2,665	2,295	950	890	441
25	470	519	785	2,100	1,821	3,788	2,955	2,665	2,373	950	828	441
26	540	691	918	2,102	1,741	3,651	2,985	2,665	2,707	950	711	441
27	675	519	1,015	2,132	1,630	3,758	2,965	2,620	2,707	950	642	441
28	675	564	894	2,332	1,626	3,758	2,930	2,595	2,838	950	324	[b]400
29	675	.....	803	2,375	1,638	2,734	2,838	2,517	2,924	892	317	[b]350
30	997	.....	826	2,739	1,675	1,634	2,843	2,306	2,606	835	230	[b]350
31	1,150	.....	836	.....	2,344	.....	2,848	2,177	.....	835	.....	[b]330

[a] Discharge too high on account of backwater.
[b] Partly estimated.

NOTE.—Daily discharge has been computed by engineers of the United States Reclamation Service and is published without change or verification.

Monthly discharge of North Platte River and Interstate canal at Whalen, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	1,300	160	617	37,900
February	1,920	157	839	46,600
March	3,480	601	1,250	76,900
April	2,740	771	1,700	101,000
May	2,870	1,260	1,910	117,000
June	5,870	1,630	3,220	192,000
July	3,680	1,770	3,250	200,000
August	3,240	2,180	2,750	169,000
September	2,920	1,960	2,250	134,000
October	2,000	781	1,060	65,200
November	1,090	230	647	38,500
December	648	239	471	29,000
The year	5,870	157	1,670	1,210,000

NOTE.—Monthly discharge computed by engineers of the United States Geological Survey from data furnished by the United States Reclamation Service and published herewith.

Daily discharge, in second-feet, of Interstate canal at Whalen, Wyo., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	448	740	1,165	175	1,250	1,225	204
2	.....	461	469	1,200	674	1,250	1,225	51
3	.....	478	469	1,225	950	1,270	1,225	0
4	.....	482	469	1,225	1,160	1,285	1,225	195
5	.....	535	400	1,230	1,210	1,285	1,225	270
6	.....	601	73	1,230	1,210	1,285	1,225	275
7	.....	667	101	1,230	1,210	770	1,225	280
8	.....	680	341	1,250	1,260	910	1,145	170
9	.....	822	350	1,270	1,260	1,180	1,115	.....
10	.....	862	549	1,270	1,260	1,200	1,115	.....
11	.....	956	592	1,270	1,200	1,200	1,010	.....
12	.....	944	645	1,270	1,275	1,200	900	.....
13	.....	974	703	1,270	1,300	1,200	895	.....
14	.....	974	698	1,200	1,320	1,225	920	.....
15	.....	1,009	712	1,240	1,330	1,260	985	.....
16	.....	1,040	715	1,260	560	1,260	1,000	.....
17	.....	1,053	723	1,285	0	1,260	1,000	.....
18	.....	1,090	713	1,285	0	1,260	1,000	.....
19	.....	1,120	713	1,285	0	1,260	1,000	.....
20	.....	1,055	732	1,285	0	1,295	1,000	.....
21	.....	1,040	811	1,285	52	1,295	1,000	.....
22	.....	1,050	815	1,285	416	1,295	1,000	.....
23	.....	1,090	920	1,260	624	1,295	1,000	.....
24	.....	1,090	990	1,190	943	1,295	1,000	.....
25	.....	1,090	1,035	1,110	1,070	1,295	1,000	.....
26	.....	1,090	1,050	1,080	1,100	1,295	1,000	.....
27	.....	1,120	1,080	1,080	1,170	1,250	1,000	.....
28	20	1,185	1,130	1,080	1,225	1,225	950	.....
29	178	1,160	1,130	850	1,240	1,225	751	.....
30	346	850	1,130	250	1,245	1,225	238	.....
31	414	.....	1,130	.....	1,250	1,225	.....	.....

NOTE.—Determination of daily discharge published as furnished by the United States Reclamation Service without change or verification.

Monthly discharge of Interstate canal at Whalen, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	0	0	0	0
February	0	0	0	0
March	414	0	30.9	1,900
April	1,180	448	900	53,600
May	1,130	73	714	43,900
June	1,280	250	1,180	70,200
July	1,330	0	895	55,000
August	1,300	770	1,230	75,600
September	1,220	238	1,020	60,700
October	280	0	46.6	2,870
November	.....	.....	0	0
December	.....	.....	0	0
The year	1,330	0	502	364,000

NOTE.—Monthly discharge computed by engineers of the United States Geological Survey from data furnished by the United States Reclamation Service and published herewith.

NORTH PLATTE RIVER NEAR MITCHELL, NEBR.

Location.—At highway bridge 1 mile south of Mitchell, on line between secs. 27 and 28, T. 23 N., R. 56 W. The nearest tributary is Spottedtail Creek, an intermittent stream entering just below the station. The only important tributary between the station and the Wyoming line is Horse Creek.

Records available.—June 3, 1901, to December 23, 1911. From May 29, 1897, to October 31, 1900, a station was maintained near Gehring. Although no tributaries enter between the two points, the records are not directly comparable during the irrigation season, as water is diverted for irrigation.

Drainage area.—24,400 square miles.

Gage.—Chain gage; datum lowered 1.00 foot on May 3, 1902, to avoid negative readings.

Channel.—Very slightly shifting.

Discharge measurements.—Made from bridge.

Winter flow.—The river is frozen over during the winter months and records are discontinued.

Artificial control.—The Pathfinder reservoir of the United States Reclamation Service controls the flow at this station to a certain extent.

Diversions.—Prior to September 1, 1912, there were approved diversions of 2,188 second-feet from the North Platte between the Wyoming-Nebraska line and Mitchell, and 75 second-feet from intervening tributaries.

Accuracy.—Conditions are favorable for accurate results and the estimates should be reliable.

Cooperation.—Station maintained in cooperation with the State engineer, by whom the field data are furnished.

Discharge measurements of North Platte River near Mitchell, Nebr., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 8	R. H. Willis	1.90	80.4
13	.....do	2.60	1,000
Aug. 4	.....do	2.35	710
Sept. 17	R. H. Fletcher	2.38	710

Daily gage height, in feet, of North Platte River near Mitchell, Nebr., for 1911.

[B. H. Newbold, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.6	1.8	2.2	2.4	2.2	.....	2.5	2.6
2	2.7	2.1	.....	2.4	2.1	2.7	2.5	2.6
3	2.9	2.0	2.7	2.4	.....	2.5	2.4	.....
4	2.9	.....	2.7	2.4	2.1	2.6	2.4	2.8
5	2.9	2.3	2.7	2.4	2.1	2.5	.....	2.7
6	3.1	2.1	2.5	.....	2.1	2.5	2.5	2.7
7	.....	2.0	2.4	2.4	2.1	2.4	2.5	2.7
8	2.9	2.0	2.5	2.4	2.2	.....	2.5	2.7
9	2.6	2.0	.....	2.9	2.2	2.5	2.5	2.7
10	2.5	2.0	2.5	2.6	.....	2.6	2.5	.....
11	2.4	.....	2.5	2.6	2.2	2.6	2.5	2.6
12	2.4	2.6	2.4	2.5	2.2	2.6	.....	2.6
13	2.4	2.6	2.4	.....	2.2	2.6	2.5	2.6
14	.....	2.6	2.4	2.5	2.3	2.7	2.6	2.5
15	2.3	2.5	2.3	2.5	2.2	.....	2.7	2.5
16	2.3	2.6	.....	2.4	2.2	2.6	2.6	2.6
17	2.2	2.8	2.9	2.4	2.4	2.5	2.6	.....
18	2.2	.....	3.0	2.4	2.3	2.5	2.5	2.6
19	2.2	3.6	3.0	2.4	2.3	2.5	.....	2.5
20	2.2	3.3	3.0	.....	2.3	2.5	2.4	2.5
21	.....	3.1	3.0	2.4	2.3	2.5	2.4	2.5
22	2.3	3.1	3.0	2.4	2.3	.....	2.5	2.5
23	2.3	3.1	.....	2.4	2.4	2.5	2.7	2.5
24	2.2	3.0	3.0	2.4	.....	2.5	2.6	.....
25	2.2	.....	2.7	2.3	2.4	2.5	2.5	.....
26	2.2	3.1	2.6	2.2	2.4	2.5	.....	.....
27	2.2	3.1	2.5	.....	2.5	2.5	2.5	.....
28	.....	3.2	2.5	2.2	2.6	.....	2.6	.....
29	2.1	2.9	2.4	2.2	2.65	.....	2.6	.....
30	2.0	2.8	.....	2.2	2.7	2.5	2.7	.....
31	1.9	.....	2.4	2.2	.....	2.5	.....	.....

Daily discharge, in second-feet, of North Platte River near Mitchell, Nebr., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	990	50	360	730	440	1,380	920	1,140
2	1,230	210	840	730	340	1,380	920	1,140
3	1,830	130	1,320	730	340	920	730	1,380
4	1,830	290	1,320	730	340	1,140	730	1,640
5	1,830	450	1,320	730	340	920	825	1,380
6	2,560	210	850	730	340	920	920	1,380
7	2,200	130	750	730	340	730	920	1,380
8	1,830	130	930	730	440	825	920	1,380
9	990	130	930	1,920	440	920	920	1,380
10	780	130	930	1,140	440	1,140	920	1,260
11	600	560	930	1,140	440	1,140	920	1,140
12	600	990	730	920	440	1,140	920	1,140
13	600	990	730	920	440	1,140	920	1,140
14	525	990	730	920	570	1,380	1,140	920
15	450	780	530	920	440	1,260	1,380	920
16	450	990	1,220	730	440	1,140	1,140	1,140
17	320	1,510	1,900	730	730	920	1,140	1,140
18	320	3,060	2,200	730	570	920	920	1,140
19	320	4,600	2,200	730	570	920	825	920
20	320	3,300	2,200	730	570	920	730	920
21	385	2,570	2,200	730	570	920	730	920
22	450	2,570	2,200	730	570	920	920	920
23	450	2,570	2,200	730	730	920	1,380	920
24	320	2,200	2,200	730	730	920	1,140	.....
25	320	2,380	1,410	570	730	920	920	.....
26	320	2,570	1,150	440	730	920	920	.....
27	320	2,570	930	440	920	920	920	.....
28	265	2,900	930	440	1,140	920	1,140	.....
29	210	1,900	730	440	1,260	920	1,140	.....
30	130	1,580	730	440	1,380	920	1,380	.....
31	80	.....	730	440	.....	920	.....	.....

NOTE.—Daily discharge determined as follows: May 1 to June 13, from a fairly well defined rating curve; June 14 to Aug. 4, by indirect method for shifting channels; Aug. 5 to Dec. 23, from well-defined curve (1910); discharge interpolated for days for which gage heights are missing.

Monthly discharge of North Platte River near Mitchell, Nebr., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	2,560	80	769	47,300	B.
June	4,600	50	1,450	86,300	B.
July	2,200	360	1,230	75,600	A.
August	1,920	440	758	46,600	A.
September	1,380	340	592	35,200	A.
October	1,380	730	1,010	62,100	A.
November	1,380	730	978	58,200	A.
December	1,640	.....	1,090	67,000	B.
The period	.....	.....	.....	478,000	

NORTH PLATTE RIVER AT NORTH PLATTE, NEBR.

Location.—At highway bridge half a mile north of North Platte, in sec. 28, T. 14 N., R. 30 W., 1 mile below mouth of Scout Creek and 4½ miles above the junction with the South Platte.

Records available.—February 25, 1895, to December 23, 1911.

Drainage area.—28,500 square miles.

Gage.—A staff gage installed October 15, 1910. From October 5, 1894, to May 31, 1910, the gage was a vertical staff at the railroad bridge 2 miles east of North Platte. On March 25, 1910, the station was moved 2 miles upstream to its present site and a chain gage reading to a different datum was installed. This gage was stolen July 1, 1910, and the records interrupted until October 15, 1910, when the present gage reading to a different datum was placed in position.

Channel.—Very shifting.

Discharge measurements.—Made from highway bridge.

Winter flow.—The river frequently freezes to the bottom during the winter, as it is very shallow.

Diversions.—Prior to September 1, 1912, there were approved diversions of 3,626 second-feet from the North Platte between Mitchell and North Platte, and 927 second-feet from intervening tributaries.

Accuracy.—Owing to the very shifting channel the estimates have been obtained by the indirect method and can be considered only fair.

Cooperation.—Station maintained in cooperation with the State engineer, by whom the field data were furnished.

Discharge measurements of North Platte River at North Platte, Nebr., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 24	A. A. Dobson	3.85	3,400	Aug. 24	A. B. Price	2.80	610
Apr. 22	A. B. Price	2.00	89.2	Sept. 24	do	2.50	222
May 20	do	2.90	547	Oct. 6	R. H. Fletcher	4.00	3,500
25	do	2.40	416	28	A. B. Price	3.40	1,420
June 21	do	3.00	891	Nov. 26	do	3.10	1,200
Aug. 11	do	3.20	969				

Daily gage height, in feet, of North Platte River at North Platte, Nebr., for 1911.

[Zack Carter, observer.]

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.1	2.9	2.8	2.5	2.7	2.7	2.5	.....	3.15	3.45
2	.....	3.2	.....	2.9	2.5	.....	2.7	2.5	2.9	3.15	3.55
3	.....	3.35	2.9	3.1	2.45	2.85	2.65	.....	3.05	3.65	.....
4	.....	3.2	2.8	3.3	.....	2.85	2.55	2.65	3.25	4.0	3.6
5	.....	.....	2.8	3.4	2.3	2.8	2.5	2.6	3.55	.....	3.6
6	4.45	3.4	2.7	3.5	2.1	2.7	.....	2.6	3.85	3.55	3.65
7	4.4	3.4	2.7	.....	1.95	2.6	3.65	2.5	3.65	3.4	3.7
8	4.35	3.5	2.6	3.8	1.95	2.25	3.55	2.5	.....	3.55	3.6
9	4.3	3.3	.....	3.65	2.0	.....	3.5	2.5	3.5	3.6	3.65
10	4.2	3.2	2.6	3.5	1.95	2.7	3.35	.....	3.35	3.55	.....
11	4.0	3.2	2.4	3.7	.....	2.6	3.05	2.5	3.3	3.45	3.65
12	.....	.....	2.25	3.7	2.05	2.5	3.0	2.5	3.35	.....	3.6
13	3.9	3.2	2.1	3.3	1.75	2.7	.....	2.5	3.3	3.3	3.55
14	3.8	3.2	2.0	.....	1.7	2.7	3.25	2.5	3.35	3.2	3.45
15	3.8	3.3	1.95	3.05	1.7	2.7	3.45	2.65	.....	3.35	3.45
16	3.8	3.3	.....	3.0	1.7	.....	3.3	2.6	3.6	3.45	3.4
17	3.7	3.1	2.0	3.1	2.55	2.6	3.1	.....	3.55	3.55	.....
18	3.7	2.95	2.25	2.8	.....	2.6	3.1	2.6	3.6	3.6	3.4
19	.....	.....	2.4	2.55	2.05	2.5	3.05	2.55	3.55	.....	3.4
20	3.6	3.0	2.3	2.4	2.0	2.5	.....	2.5	3.45	3.6	3.45
21	3.55	3.1	2.2	.....	2.95	2.4	3.15	2.4	3.4	3.6	3.5
22	3.4	3.2	2.0	2.4	2.7	2.55	2.95	2.45	.....	3.5	3.6
23	3.5	3.4	.....	2.4	3.6	.....	2.9	2.5	3.5	3.35	3.7
24	3.45	3.75	2.0	2.5	3.6	3.5	2.8	2.5	3.45	3.2	.....
25	3.5	3.85	2.0	2.5	.....	3.45	2.75	2.6	3.45	3.0	.....
26	.....	.....	2.0	2.3	3.55	3.3	2.7	2.6	3.45	3.1	.....
27	3.3	3.75	2.0	2.45	3.4	3.35	.....	2.7	3.4	3.0	.....
28	3.4	3.5	2.2	.....	3.3	3.2	2.7	2.75	3.4	3.1	.....
29	.....	3.35	2.3	2.8	3.05	3.15	2.6	2.8	.....	3.25	.....
30	.....	3.1	.....	2.65	2.75	.....	2.6	2.8	3.3	3.35	.....
31	.....	2.95	.....	2.6	.....	2.85	2.6	.....	3.25	.....	.....

NOTE.—River free from ice Feb. 13; frozen over Dec. 24 to 31.

Daily discharge, in second-feet, of North Platte River at North Platte, Nebr., for 1911.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1,200	850	600	480	480	400	320	562	900	2,050
2	.....	1,400	850	650	480	565	400	320	625	900	2,350
3	.....	1,780	850	925	440	650	370	360	925	1,950	2,420
4	.....	1,400	750	1,300	370	650	300	400	1,500	3,080	2,500
5	.....	1,650	750	1,750	300	590	270	350	1,850	2,390	2,500
6	.....	1,900	650	2,000	200	480	1,110	350	3,000	1,700	2,680
7	.....	1,900	650	2,320	150	370	1,950	300	2,300	1,550	2,850
8	.....	2,200	550	2,650	150	160	1,700	300	2,080	1,900	2,500
9	.....	1,650	525	2,150	175	305	1,570	300	1,850	2,050	2,680
10	.....	1,400	500	1,750	150	450	1,240	300	1,500	1,900	2,680
11	.....	1,400	375	2,150	175	370	740	300	1,400	1,650	2,680
12	.....	1,400	275	2,150	200	300	670	350	1,500	1,480	2,500
13	3,550	1,400	225	1,200	110	450	860	300	1,400	1,300	2,350
14	3,200	1,400	175	988	100	450	1,050	250	1,400	1,100	2,050
15	3,200	1,650	165	775	100	450	1,600	350	1,720	1,300	2,050
16	3,200	1,650	170	700	100	410	1,250	325	2,030	1,650	1,900
17	2,850	1,200	175	850	495	370	900	325	1,900	2,100	1,900
18	2,850	975	275	475	338	370	900	325	2,000	2,250	1,900
19	2,680	988	375	275	180	300	825	300	1,900	2,250	1,900
20	2,500	1,050	300	200	160	300	938	250	1,620	2,250	2,050
21	2,350	1,200	250	185	825	225	1,050	200	1,400	2,250	2,200
22	1,900	1,400	175	170	360	300	750	230	1,520	2,000	2,500
23	2,200	1,900	132	225	2,150	975	675	250	1,650	1,600	2,850
24	2,050	3,020	90	300	2,150	1,650	550	250	1,500	1,250	.....
25	2,200	3,250	90	375	2,080	1,530	540	280	1,530	900	.....
26	1,920	3,080	90	350	2,000	1,200	480	280	1,530	1,050	.....
27	1,650	2,900	90	450	1,600	1,300	480	360	1,400	1,050	.....
28	1,900	2,050	160	610	1,380	1,130	480	400	1,400	1,200	.....
29	.....	1,650	200	770	925	950	400	500	1,290	1,520	.....
30	.....	1,050	400	600	540	750	400	500	1,150	1,780	.....
31	.....	900	.....	560	.....	550	400	.....	1,050	.....	.....

NOTE.—Daily discharge determined from a series of parallel rating curves and by the indirect method for shifting channels. Discharge interpolated for days for which gage heights are missing.

Monthly discharge of North Platte River at North Platte, Nebr., for 1911.

[Drainage area, 28,500 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
February 13-28	3,550	1,650	2,510	0.088	0.05	79,600
March	3,250	900	1,680	.059	.07	103,000
April	850	90	370	.013	.01	22,000
May	2,650	170	982	.034	.04	60,400
June	2,150	100	629	.022	.02	37,400
July	1,650	160	614	.022	.03	37,800
August	1,950	400	814	.029	.03	50,100
September	500	200	319	.011	.01	19,000
October	3,000	562	1,560	.055	.06	95,900
November	3,080	900	1,680	.059	.07	100,000
December	2,850	1,900	2,390	.084	.10	147,000
The period						752,000

Discharge estimated at 2,500 second-feet Dec. 24 to 31.

PLATTE RIVER NEAR COLUMBUS, NEBR.

Location.—At Meridian bridge 3 miles south of Columbus on line between sec. 36, T. 17 N., R. 1 W., and sec. 31, T. 17 N., R. 1 E., about 10 miles below the mouth of Prairie Creek and 5 miles above the mouth of Loup River.

Records available.—June 4, 1895, to December 31, 1911.

Drainage area.—56,900 square miles.

Gage.—A chain gage installed July 25, 1910. The bridge and the original gage previously used were washed out early in 1910. The new gage is at the same point as the old, but its datum is possibly slightly different. The datum of the original gage was unchanged up to the time of its destruction.

Channel.—Extremely shifting; at this point the river flows in the channels known as the main, middle, and south channels. The gage is located in the main channel.

Discharge measurements.—Made from bridges spanning each channel.

Winter flow.—The river freezes over during the winter and records are discontinued.

Diversions.—Prior to September 1, 1912, there were approved diversions of 4,888 second-feet for irrigation and 1,500 second-feet for power from Platte River between the junction of the two branches and Columbus, and this diversion, together with the evaporation from the wide shallow channels, frequently causes the flow to cease at this point during the late summer and fall.

Accuracy.—The extremely shifting channel makes it impossible to make estimates of daily discharge without almost weekly discharge measurements, as the gage heights are little if any index of the flow.

Cooperation.—Station maintained in cooperation with the State engineer, by whom the field data were furnished.

Discharge measurements of Platt River near Columbus, Nebr., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 23	A. A. Dobson	1.45	803	Aug. 25	A. B. Price	0.90	761
Apr. 25	A. B. Price	0	73.1	Sept. 11	do	.10	93
May 18	do	1.15	1090	Sept. 24	do	−.30	29.7
May 26	do	.80	387	Oct. 4	do	1.80	36.9
				Nov. 10	do	3.15	1,400

Daily gage height, in feet, of Platte River near Columbus, Nebr., for 1911.

[W. D. Benson, observer.]

Day.	Mar.	Apr.	May.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.8	0.5			+0.3		3.05
2		1.8	.3			+ .15	2.55	
3		1.85	.2					
4		1.7	.5			1.8	2.8	3.35
5		1.6	.65			2.15	2.75	3.1
6		1.65	.7			3.0	2.95	
7		1.65	.7			2.85	3.0	
8		1.65	.7			2.7	3.3	
9		1.6	.8			3.4	2.65	
10			.9			3.5	2.45	3.3
11		1.55	.7		+0.1	3.65		3.1
12	2.1		.5		+ .35	3.5		3.15
13		1.2			− .05	3.45		3.05
14	1.8	([a])	1.65		− .25	3.35		3.0
15	1.55		1.3		+ .95	3.2		2.95
16	1.5				+ .8	3.1		3.1
17	1.35		1.3		+ .7	3.0		3.0
18	1.3		1.15		+ .45	2.9		
19	1.3				.35	3.05		2.85
20	1.3				.25	3.0	3.15	
21	1.2		1.0		.15	3.15	3.3	2.9
22	1.2		.9		− .05	3.05	3.2	2.75
23	1.45		.8			2.8		2.65
24	1.65		.75		− .3	3.0		
25	1.65	.0	.65	.9		3.0	3.35	2.95
26	1.4	.2	.8			2.95		
27	1.5	.2	.75			3.05		
28	1.65		.5			3.2		
29	1.8	.75	.45			3.1		
30	2.05	.4	.2	.05		3.2		
31	1.85			1.15		3.15		

[a] Sand bar under gage.

NOTE.—Channel dry Apr. 17 to 25, May 31 to Aug. 24, and Sept. 25 to 30. Ice caused backwater at gage from Nov. 11 to Dec. 31.

PLATTE RIVER NEAR LESHARA, NEBR.

Location.—At highway bridge 2 miles southeast of Leshara, about sec. 34, T. 16 N., R. 9 E.; 7 miles above the entrance of Otoe Creek.

Records available.—May 19 to December 31, 1911.

Drainage area.—Not measured.

Gage.—Chain; datum unchanged.

Channel.—Extremely shifting.

Discharge measurements.—Made from the highway bridge.

Winter flow.—Data too meager to determine.

Diversions.—Prior to September 1, 1912, there were approved diversions of 2,500 second-feet for power and irrigation and 4,000 second-feet for power from Platte River between the mouth of Loup River and this station. Below there were approved diversions of 2,500 second-feet for power.

Accuracy.—Daily records can be considered only approximately accurate.

Cooperation.—Station maintained by the State engineer, by whom the field data are furnished.

Discharge measurements of Platte River near Leshara, Nebr., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 19	A. B. Price	2.85	4,070	Aug. 10	A. B. Price	2.60	2,250
30	do	2.70	2,880	27	do	2.80	2,730
June 12	do	2.20	1,510	Sept. 11	do	4.00	7,710
23	do	2.30	1,170	Oct. 3	do	2.90	2,950
July 8	do	2.05	1,110	Nov. 9	do	3.00	4,220
31	do	2.20	1,320				

Daily gage height, in feet, of Platte River near Leshara, Nebr., for 1911.

[H. M. Eggers, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.50	2.28	2.25	2.48	2.80	3.30	3.15
2	.....	2.52	2.28	2.25	2.39	2.90	3.00	3.05
3	.....	2.55	2.05	2.40	2.38	2.90	2.95	3.00
4	.....	2.50	1.80	2.88	2.40	2.80	2.60	3.20
5	.....	2.44	2.05	2.62	2.40	2.85	2.85	3.60
6	.....	2.30	1.95	2.47	2.38	3.08	2.20	3.40
7	.....	2.25	2.05	2.50	2.39	5.20	2.60	3.30
8	.....	2.40	2.00	2.66	2.50	4.26	3.00	3.35
9	.....	2.52	2.35	2.75	2.55	3.55	3.05	3.42
10	.....	2.40	2.26	2.60	2.61	3.42	3.20	3.35
11	.....	2.35	2.38	2.58	2.60	3.30	3.15	3.55
12	.....	2.22	2.36	2.70	3.60	3.23	3.10	3.40
13	.....	2.3	2.56	2.75	2.83	3.20	3.30	3.30
14	.....	2.40	2.46	2.60	3.23	3.35	3.10	3.25
15	.....	2.30	3.15	2.58	2.60	3.21	3.00	3.20
16	.....	2.39	2.72	2.53	2.57	3.05	2.80	3.15
17	.....	2.30	2.73	2.50	2.80	3.00	2.65	3.05
18	.....	2.29	2.90	2.68	2.70	3.10	2.45	3.00
19	2.85	2.30	2.30	2.85	2.62	3.15	3.40	2.80
20	.....	2.35	2.20	2.90	2.58	2.95	4.00	2.85
21	.....	2.54	2.20	2.85	2.57	3.12	3.70	2.95
22	.....	2.32	2.40	2.80	2.70	3.10	3.00	3.10
23	.....	2.30	2.30	2.60	2.60	3.07	2.90	3.00
24	3.25	2.28	2.40	3.25	2.50	3.00	2.60	2.90
25	3.05	2.25	3.50	3.15	2.58	3.05	2.64	2.85
26	2.70	2.13	3.30	2.20	2.50	3.00	2.80	2.95
27	2.60	2.13	3.89	2.70	2.55	3.05	3.00	2.80
28	2.72	2.20	2.87	2.68	2.53	2.95	3.10	2.70
29	2.60	2.60	2.51	2.57	2.45	3.15	3.30	3.10
30	2.65	2.43	2.50	2.55	2.85	3.10	3.29	3.00
31	2.62	.....	2.33	2.52	.....	3.16	.....	3.05

Daily discharge, in second-feet, of Platte River near Leshara, Nebr., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2,200	1,350	1,400	1,870	2,700	5,300	4,800
2	.....	2,250	1,350	1,400	1,670	3,020	4,050	4,400
3	.....	2,320	1,050	1,690	1,650	3,020	3,850	4,200
4	.....	2,200	820	2,960	1,690	2,700	2,700	5,000
5	.....	2,050	1,050	2,200	1,690	2,860	3,500	6,850
6	.....	1,750	1,000	1,840	1,650	3,630	1,740	5,900
7	.....	1,650	1,120	1,910	1,670	14,300	2,860	5,450
8	.....	1,950	1,060	2,310	1,910	9,100	4,220	5,680
9	.....	2,250	1,590	2,560	2,030	5,520	4,420	5,990
10	.....	1,950	1,420	2,150	2,180	5,300	4,610	5,680
11	.....	1,600	1,650	2,100	2,150	4,750	4,800	6,600
12	.....	1,400	1,610	2,410	5,750	4,450	4,600	5,900
13	.....	1,550	2,050	2,560	2,800	4,350	5,450	5,450
14	.....	1,750	1,820	2,150	4,220	5,000	4,600	5,220
15	.....	1,300	3,900	2,100	2,150	4,430	4,200	5,000
16	.....	1,610	2,470	1,980	2,080	3,780	3,500	4,800
17	.....	1,300	2,500	1,910	2,700	3,600	3,000	4,400
18	.....	1,280	3,020	2,360	2,410	3,950	2,420	4,200
19	4,070	1,300	1,490	2,800	2,200	4,400	5,900	3,500
20	4,350	1,380	1,310	3,020	2,100	3,650	8,850	3,080
21	4,620	1,700	1,310	2,860	2,080	4,300	7,350	4,020
22	4,900	1,170	1,690	2,700	2,410	4,200	4,200	4,600
23	5,170	1,150	1,490	2,150	2,150	4,050	3,850	4,200
24	5,450	1,140	1,690	4,300	1,910	3,850	2,850	3,850
25	4,300	1,080	5,300	3,900	2,100	4,000	2,970	3,080
26	3,050	1,050	4,500	1,310	1,910	3,850	3,500	4,020
27	2,750	1,050	7,150	2,410	2,030	4,000	4,200	3,500
28	2,810	1,140	2,920	2,360	1,980	3,850	4,600	3,150
29	2,450	1,750	1,930	2,080	1,800	4,650	5,450	4,600
30	2,600	1,430	1,910	2,030	2,860	4,400	5,400	4,200
31	2,510	.....	1,550	1,960	.....	4,700	.....	4,400

NOTE.—Daily discharge determined from several poorly defined rating curves and by indirect method for shifting channels.

Monthly discharge of Platte River near Leshara, Nebr., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May 19-31	5,450	2,450	3,770	100,000	C.
June	2,320	1,050	1,590	94,600	C.
July	7,150	820	2,100	129,000	C.
August	4,300	1,310	2,320	143,000	C.
September	5,750	1,650	2,260	134,000	C.
October	14,300	2,700	4,530	279,000	C.
November	8,850	1,740	4,300	256,000	C.
December	6,850	3,150	4,740	291,000	C.
The period	.....	.....	.....	1,430,000	

BIG CREEK NEAR DOWNINGTON, WYO.

Location.—In the NE.¼ SW.¼ sec. 32, T. 13 N., R. 81 W., below all important tributaries. One small creek enters below the gaging station. This station is in the Hayden National Forest.

Records available.—Gage heights, May 7 to June 17, 1911.

Drainage area.—Not measured.

Gage.—Staff.

Accuracy.—As no discharge measurements have been made, no estimates of discharge can be made.

Cooperation.—This station is maintained in cooperation with the United States Forest Service.

Daily gage height, in feet, of Big Creek near Downington, Wyo., for 1911.

Day.	May.	June.	Day.	May.	June.	Day.	May.	June.
1	.....	2.6	11	2.2	3.1	21	2.3	.....
2	.....	3.0	12	2.2	3.2	22	2.3	.....
3	.....	3.1	13	2.4	3.2	23	2.2	.....
4	.....	3.1	14	2.4	3.1	24	2.4	.....
5	.....	3.2	15	2.6	3.1	25	2.6	.....
6	.....	3.3	16	2.6	4.1	26	2.4	.....
7	2.7	4.0	17	2.5	3.2	27	2.4	.....
8	2.4	3.5	18	2.4	.....	28	2.5	.....
9	2.4	3.3	19	2.3	.....	29	2.5	.....
10	2.2	3.2	20	2.4	.....	30	2.6	.....
						31	2.8	.....

MULLEN CREEK NEAR FRENCH, WYO.

Location.—At old highway bridge in sec. 33, T. 15 N., R. 80 W., 10 miles east of French post office. There is no important tributary between the station and the junction with the South Fork, 6 miles below. This station is in the Cheyenne National Forest.

Records available.—Fragmentary records, June 21 to September 24, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Data too meager to determine condition.

Discharge measurements.—Made by wading.

Winter flow.—No information.

Diversions.—No water is diverted above the station, and therefore the records represent the natural run-off.

Accuracy.—Owing to insufficient data no estimates of flow can be made.
Cooperation.—Station maintained in cooperation with the State engineer.

The following discharge measurement was made by R. H. Fletcher:
June 21, 1911: Gage height, 1.90 feet; discharge, 72 second-feet.

Daily gage height, in feet, of Mullen Creek near French, Wyo., for 1911.

[Martin Farrell, observer.]

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1					16		1.25		
2		1.4			17				.9
3				1.05	18				
4					19				
5					20			1.1	
6			1.1		21	1.9			
7					22				
8					23				
9		1.3			24		1.2		.9
10				1.0	25				
11					26			1.1	
12					27	1.6			
13			1.05		28				
14					29				
15					30		1.1		
					31				

FRENCH CREEK NEAR FRENCH, WYO.

Location.—In sec. 4, T. 14 N., R. 81 W., about 3½ miles southeast of French. The station is 2 miles above the mouth, and is below all tributaries. This station is in the Cheyenne National Forest.
Records available.—April 30 to July 15, 1911.
Drainage area.—Fifty-seven square miles (measured from Forest atlas).
Gage.—Vertical staff.
Channel.—Somewhat shifting.
Discharge measurements.—Made by wading.
Diversions.—No water is diverted above the station, and therefore the records represent the natural flow. Prior to July 1, 1912, there were adjudicated diversions for 3 second-feet below the station. From North French Creek there is an adjudicated diversion of 4 second-feet.
Accuracy.—Conditions are favorable for good results, and the estimates should be reliable.
Cooperation.—Station maintained in cooperation with the State engineer.

Discharge measurements of French Creek near French, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Apr. 30	Fletcher and Kingdon	1.60	46.6
May 31	R. H. Fletcher	2.60	433
June 11	do	2.50	385
21	do	2.65	429
July 12	do	1.82	85.9

Daily gage height, in feet, and discharge, in second-feet, of French Creek near French, Wyo., for 1911.

[Mrs. J. W. Jenkins, observer.]

Day.	April.		May.		June.		July.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			1.55	44	2.90	610	2.20	225
2			1.52	40	2.90	610	2.15	202
3			1.50	38	2.85	580	2.10	180
4			1.55	44	2.85	580	2.10	180
5			1.72	69	2.80	550	2.05	160
6			1.92	114	2.90	610	2.00	140
7			2.00	140	3.05	702	2.00	140
8			2.20	225	3.35	898	2.00	140
9			2.35	300	2.95	640	1.95	124
10			2.25	250	2.90	610	1.90	107
11			2.12	189	3.00	670	1.85	95
12			2.00	140	2.85	580	1.80	83
13			2.20	225	2.85	580	1.80	83
14			2.28	265	2.85	580	1.80	83
15			2.45	352	3.00	670	1.80	83
16			2.50	380	3.25	832		
17			2.55	408	2.95	640		
18			2.55	408	2.85	580		
19			2.35	300	2.85	580		
20			2.18	216	2.95	640		
21			2.12	189	2.90	610		
22			2.20	225	2.80	550		
23			2.30	275	2.70	490		
24			2.35	300	2.60	435		
25			2.48	369	2.50	380		
26			2.45	352	2.40	325		
27			2.35	300	2.32	285		
28			2.45	352	2.30	275		
29			2.55	408	2.25	250		
30	1.62	53	2.70	490	2.20	225		
31			2.75	520				

NOTE.—Daily discharge determined from a rating curve that is fairly well defined at all gage heights.

Monthly discharge of French Creek near French, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	520	38	256	15,700	B.
June	898	225	552	32,800	B.
July 1–15	225	83	135	4,020	B.

BRUSH CREEK NEAR SARATOGA, WYO.

Location.—On the county bridge half a mile above the mouth, about sec. 8, T. 15 N., R. 82 W. It is 18 miles southeast of Saratoga. There is no tributary below the station, and none for several miles above.

Records available.—April 28 to October 15, 1911.

Drainage area.—Not measured.

Gage.—Chain gage type.

Channel.—Apparently permanent.

Discharge measurements.—Made from bridge.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions from Brush Creek amounting to 87 second-feet, and from its tributaries 27 second-feet. Nearly all the diversions are above the station.

Accuracy.—Conditions are favorable for accurate results, and the estimates of flow should be reliable.

Cooperation.—Station maintained in cooperation with State engineer.

Discharge measurements of Brush Creek near Saratoga, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 28	Fletcher and Kingdon	2.75	111	June 22	R. H. Fletcher	3.80	410
June 1	R. H. Fletcher	4.35	759	July 12	do	1.65	17.7
11	do	3.80	339	Oct. 7	G. H. Russell	2.23	42.3

Daily gage height, in feet, of Brush Creek near Saratoga, Wyo., for 1911.

[Garland Gross, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1		2.6	4.3	2.05	1.2	1.35	2.35
2		2.6	4.45	2.1	1.25	1.3	2.45
3		2.7	4.1	2.05	1.25	1.35	2.65
4		3.0	4.1	2.1	1.25	1.25	2.55
5			3.7	1.95	1.15	1.25	2.5
6		3.15	4.1	2.05	1.15	1.2	2.55
7		3.7	4.1	2.0	1.25	1.25	2.4
8		3.85	4.2	1.85	1.25	1.2	2.25
9		3.85	4.4	1.65	1.35	1.35	2.5
10		3.5	3.7	1.65	1.45	1.3	2.4
11		3.45	4.1	1.7	1.45	1.35	2.15
12		3.55	4.2	1.65	1.45	1.35	1.95
13		3.4	4.1	1.7	1.45	1.3	1.8
14		3.65	4.2	1.7	1.4	1.2	1.85
15		3.9	4.8	1.75	1.3	1.25	1.65
16		3.95	4.6	1.6	1.25	1.25	
17		4.05	4.6	1.6	1.25	1.2	
18		4.0	4.6	1.65	1.25	1.2	
19		3.6	4.25	1.55	1.15	1.35	
20		3.4	4.35	1.55	1.25	1.3	
21		3.3	4.2	1.8	1.4	1.35	
22		3.35	4.2	1.8	1.5	1.35	
23		3.65	4.05	1.7	1.6	1.6	
24		3.45	3.95	1.65	1.65	1.6	
25		3.35	3.05	1.6	1.55	1.6	
26		3.15	2.55	1.5	1.45	1.6	
27		3.8	2.3	1.5	1.4	1.5	
28	2.78	3.6	2.05	1.45	1.3	1.25	
29	2.5	3.75	2.0	1.35	1.3	1.25	
30	2.0	4.1	2.0	1.25	1.4	1.55	
31		4.3		1.3	1.4		

Daily discharge, in second-feet, of Brush Creek near Saratoga, Wyo., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	88	690	32	4	7	57
2	.....	88	815	35	5	6	68
3	.....	103	540	32	5	7	96
4	.....	154	540	35	5	5	81
5	.....	170	345	26	3	5	74
6	.....	186	540	32	3	4	81
7	.....	345	540	29	5	5	62
8	.....	408	610	22	5	4	48
9	.....	408	770	14	7	7	74
10	.....	280	345	14	9	6	62
11	.....	265	540	16	9	7	39
12	.....	295	610	14	9	7	26
13	.....	250	540	16	9	6	20
14	.....	328	610	16	8	4	22
15	.....	430	1,140	18	6	5	14
16	.....	455	950	13	5	5	14
17	.....	510	950	13	5	4	14
18	.....	480	950	14	5	4	14
19	.....	310	650	12	3	7	14
20	.....	250	730	12	5	6	14
21	.....	223	610	20	8	7	14
22	.....	236	610	20	10	7	14
23	.....	328	510	16	13	13	14
24	.....	265	455	14	14	13	14
25	.....	236	164	13	12	13	14
26	.....	186	81	10	9	13	14
27	.....	385	52	10	8	10	14
28	116	310	32	9	6	5	14
29	74	365	29	7	6	5	14
30	29	540	29	5	8	12	14
31	.....	690	.....	6	8	.....	14

NOTE.—Daily discharge determined from a rating curve fairly well-defined between 10 and 860 second-feet. Discharge estimated Oct. 15 to 31.

Monthly discharge of Brush Creek near Saratoga, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
April 28–30	.....	.....	73	434	B.
May	690	88	309	19,000	B.
June	1,140	29	533	31,700	B.
July	35	5	17.6	1,080	B.
August	14	3	7.0	430	B.
September	13	4	7.0	417	B.
October	96	14	33.8	2,080	D.
November	.....	.....	[a] 15.0	892	
December	.....	.....	[a] 10.0	615	
The period	.....	.....	.....	56,600	

[a] Discharges estimated.

ENCAMPMENT RIVER AT ENCAMPMENT, WYO.

Location.—At the lower end of the smelter grounds at Encampment, in sec. 6, T. 14 N., R. 83 W. The nearest tributary is the North Fork, which enters 1 mile above.

Records available.—May 2 to November 10, 1911.

Drainage area.—235 square miles (measured from topographic sheets and King's Atlas).

Gage.—Chain gage type.

Channel.—A short distance below the station is a low diversion dam which may cause backwater whenever additional brush or drift collects on its crest.

Discharge measurements.—Made from car and cable.

Winter flow.—Ice causes backwater during the winter months, and the records are discontinued.

Diversions.—Three large irrigation ditches divert water at a point 1 mile above the station. The smelter company has a pipe line which diverts water above the station, but as the tailrace of the power plant which the pipe line supplies is located just above the station, the amount diverted passes the gage. Water is also diverted below the station. Prior to July 1, 1912, there were adjudicated diversions from Encampment River amounting to 61 second-feet and from tributaries entering above 31 second-feet.

Accuracy.—The lodging of débris on the point of control makes the conditions somewhat uncertain, and therefore the estimates of flow can not be considered better than fair or possibly good.

Cooperation.—Station maintained in cooperation with the State engineer.

Discharge measurements of Encampment River at Encampment, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 2	Fletcher and Kingdon	4.00	331	June 20	R. H. Fletcher	5.35	1,250
30	R. H. Fletcher	5.80	1,540	July 11	do	3.50	200
June 10	do	5.55	1,450	Oct. 7	G. H. Russell	3.90	177

Daily gage height, in feet, of Encampment River at Encampment, Wyo., for 1911.

[Paul N. Elderkin, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	6.4	4.20	2.80	3.10	4.15	3.4
2	4.00	6.3	4.1	2.8	3.3	3.65	3.3
3	3.85	6.2	4.1	2.8	3.2	3.85	3.15
4	3.95	6.2	4.1	2.7	3.3	3.6	3.2
5	4.5	6.2	4.0	2.7	3.25	4.5	3.35
6	5.0	6.0	3.8	2.7	3.3	4.0	3.2
7	5.1	6.0	3.7	2.8	3.15	3.9	3.35
8	5.6	6.6	3.6	2.7	3.1	3.8	3.5
9	5.5	5.6	3.5	2.8	3.1	3.8	3.35
10	5.4	5.5	3.5	2.9	3.15	3.75	3.35
11	5.2	5.7	3.5	3.1	3.15	3.7	.....
12	5.3	5.3	3.5	3.1	3.15	3.65	.....
13	5.6	5.2	3.65	3.1	3.1	3.65	.....
14	5.8	5.4	3.6	3.1	3.15	3.6	.....
15	5.9	6.3	3.75	3.1	3.15	3.6	.....
16	5.8	6.2	3.5	3.1	3.15	3.5	.....
17	5.6	6.4	3.4	3.1	3.0	3.6	.....
18	5.5	5.4	3.4	3.0	2.95	3.6	.....
19	5.4	5.2	3.55	3.0	3.0	3.6	.....
20	5.2	5.4	3.4	3.0	3.1	3.4	.....
21	5.0	5.4	3.5	3.1	3.05	3.5	.....
22	5.0	5.2	3.4	3.1	3.1	3.5	.....
23	5.1	5.2	3.4	3.1	3.3	3.5	.....
24	5.2	5.0	3.4	3.1	3.2	3.45	.....
25	5.4	4.8	3.4	3.1	3.2	3.45	.....
26	6.0	4.6	3.2	3.1	3.1	3.4	.....
27	6.0	4.6	3.1	3.1	3.1	3.4	.....
28	5.9	4.45	3.0	3.0	3.2	3.4	.....
29	5.8	4.35	2.8	3.0	3.1	3.4	.....
30	5.8	4.25	2.8	3.0	4.1	3.3	.....
31	6.2	.....	2.85	3.1	.....	3.35	.....

Daily discharge, in second-feet, of Encampment River at Encampment, Wyo., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	300	2,240	432	72	114	385	85
2	344	2,130	386	72	151	180	74
3	289	2,030	386	72	132	230	62
4	325	2,030	386	62	151	150	65
5	595	2,030	344	62	142	440	80
6	935	1,830	272	62	151	220	65
7	1,020	1,830	242	72	123	190	80
8	1,440	2,460	215	62	114	150	98
9	1,360	1,440	192	72	114	150	80
10	1,260	1,360	192	84	123	140	80
11	1,100	1,540	192	114	123	130	.....
12	1,180	1,180	192	114	123	122	.....
13	1,440	1,100	228	114	114	122	.....
14	1,640	1,260	215	114	123	113	.....
15	1,730	2,130	257	114	123	113	.....
16	1,640	2,030	192	114	123	98	.....
17	1,440	2,240	171	114	98	113	.....
18	1,360	1,260	171	98	91	113	.....
19	1,260	1,100	204	98	98	113	.....
20	1,100	1,260	171	98	114	85	.....
21	935	1,260	192	114	106	98	.....
22	935	1,100	171	114	114	98	.....
23	1,020	1,100	171	114	151	98	.....
24	1,100	935	171	114	132	92	.....
25	1,260	790	171	114	132	92	.....
26	1,830	655	132	114	114	85	.....
27	1,830	655	114	114	114	85	.....
28	1,730	566	98	98	132	85	.....
29	1,640	510	72	98	114	85	.....
30	1,640	457	72	98	375	74	.....
31	2,030	.....	78	114	.....	80	.....

NOTE.—Daily discharge determined as follows: May 2 to Sept. 29, from curve fairly well defined; Oct. 8 to Nov. 10, from poorly defined curve; Sept. 30 to Oct. 7, by indirect method for shifting channels.

Monthly discharge of Encampment River at Encampment, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	2,030	289	1,220	75,000	C.
June	2,460	457	1,420	84,500	C.
July	432	72	209	12,900	C.
August	114	62	96.5	5,930	C.
September	375	91	131	7,800	C.
October	440	74	140	8,610	D.
November 1–10	98	62	76.9	1,530	D.
The period	.....	.....	.....	196,000	

COW CREEK NEAR SARATOGA, WYO.

Location.—At highway bridge in sec. 36, T. 16 N., R. 84 W., and 9 miles south of Saratoga. There are no tributaries between the station and the mouth, 4 miles below. Calf Creek enters about 2 miles above.

Records available.—May 3, 1911, to October 31, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Shifting.

Discharge measurements.—Made from bridge during high water, and by wading at ordinary stages.

Winter flow.—Ice causes backwater during the winter months and the records are discontinued.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions from Cow Creek of 84 second-feet and from its tributaries, 27 second-feet, nearly all above the station.

Accuracy.—Owing to the shifting channel the estimates have been obtained by the indirect method and can only be considered fair.

Cooperation.—Station maintained in cooperation with the State engineer.

Discharge measurements of Cow Creek near Saratoga, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 3	Fletcher and Kingdon.	2.30	34.1	June 20	R. H. Fletcher	3.00	150
29	R. H. Fletcher	2.75	95.6	July 11	do	2.00	2.1
June 10	do	3.10	140	Oct. 6	G. H. Russell	2.34	24.4

Daily gage height, in feet, of Cow Creek near Saratoga, Wyo., for 1911.

[Margaret Sullivan, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.95	2.30	2.0	2.05	2.2	16	3.00	3.45	2.05	2.0	2.0	2.2
2	.....	2.90	2.22	2.0	2.05	2.2	17	2.95	3.35	2.05	2.0	2.0	2.2
3	2.30	3.15	2.22	2.0	2.05	2.2	18	2.95	3.25	2.0	2.0	2.0	2.2
4	2.30	3.25	2.28	2.0	2.05	2.3	19	2.98	3.00	2.0	2.0	2.0	2.2
5	2.30	3.18	2.30	2.0	2.0	2.32	20	2.92	3.00	2.05	2.0	2.0	2.2
6	2.55	3.29	2.40	2.0	2.02	2.35	21	2.90	2.95	2.0	2.0	2.0	2.2
7	2.65	3.28	2.15	2.0	2.0	2.25	22	2.75	2.92	2.0	2.05	2.0	2.2
8	2.80	3.38	2.0	2.0	2.0	2.22	23	2.65	2.80	2.0	2.0	2.0	2.2
9	3.05	3.40	2.0	2.0	2.0	2.2	24	2.75	2.75	2.0	2.0	2.0	2.2
10	3.05	3.10	2.0	2.05	2.0	2.2	25	2.85	2.70	2.0	2.0	2.0	2.2
11	2.70	2.98	2.0	2.0	2.0	2.2	26	3.00	2.68	2.0	2.0	2.0	2.2
12	2.60	2.95	2.0	2.0	2.0	2.2	27	2.85	2.60	2.05	2.0	2.0	2.2
13	2.48	3.00	2.0	2.0	2.0	2.2	28	2.90	2.40	2.0	2.0	2.0	2.2
14	2.78	3.05	2.1	2.0	2.0	2.2	29	2.75	2.45	2.0	2.05	2.0	2.2
15	2.98	3.15	2.15	2.0	2.0	2.2	30	2.70	2.45	2.05	2.05	2.05	2.2
							31	2.65	.....	2.0	2.05	.....	2.2

Daily discharge, in second-feet, of Cow Creek near Saratoga, Wyo., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	25	129	30	2	5	16	16	143	218	5	2	2	8
2	25	116	20	2	5	16	17	134	204	5	2	2	8
3	30	147	20	2	5	14	18	134	184	2	2	2	8
4	30	180	28	2	5	25	19	139	143	2	2	2	8
5	30	162	30	2	2	25	20	129	143	5	2	2	8
6	66	184	44	2	3	24	21	125	134	2	2	2	8
7	82	183	13	2	2	13	22	98	129	2	5	2	8
8	107	193	2	2	2	10	23	82	107	2	2	2	8
9	152	197	2	2	2	8	24	98	98	2	2	2	8
10	152	142	2	5	2	8	25	116	90	2	2	2	8
11	90	126	2	2	2	8	26	143	87	2	2	2	8
12	74	121	2	2	2	8	27	116	74	5	2	2	8
13	56	129	2	2	2	8	28	125	44	2	2	2	8
14	104	143	8	2	2	8	29	98	52	2	5	2	8
15	139	160	13	2	2	8	30	86	52	5	5	5	8
							31	78	.....	2	5	.....	8

NOTE.—Daily discharge determined as follows: May 3 to 29 and June 21 to Sept. 30 from curve fairly well defined at all gage heights; Oct. 7 to 31, from poorly-defined curve; May 30 to June 20 and Oct. 1 to 6 by indirect method for shifting channels.

Monthly discharge of Cow Creek near Saratoga, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	152	25	97.0	5,960	C.
June	218	44	136	8,090	C.
July	44	2	8.5	523	C.
August	5	2	2.5	154	C.
September	5	2	2.5	149	C.
October	25	8	10.5	646	C.
The period				15,500	

SPRING CREEK NEAR SARATOGA, WYO.

Location.—At highway bridge, in sec. 23, T. 17 N., R. 84 W., and 2 miles southwest of Saratoga. There is no tributary between the station and the mouth, three-fourths of a mile below.

Records available.—May 3 to October 31, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Somewhat shifting.

Discharge measurements.—Made from bridge during high water and by wading at ordinary stages.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions of 5 second-feet from Spring Creek, 85 second-feet from North Spring Creek, and 104 second-feet from South Spring Creek. These diversions are all above the station.

Accuracy.—Owing to the somewhat shifting channel the estimates of discharge can not be considered better than fair or possibly good.

Cooperation.—Station maintained in cooperation with the State engineer.

Dicharge measurements of Spring Creek near Saratoga, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 3	Fletcher and Kingdon	1.00	41.3	June 20	R. H. Fletcher	2.05	219
29	R. H. Fletcher	2.00	176	July 11	do	.52	[a] 1.5
June 10	do	3.00	356	Oct. 6	G. H. Russell	1.23	56.0

[a] Estimated.

Daily gage height, in feet, and discharge, in second-feet, of Spring Creek near Saratoga, Wyo., for 1911.

[Vada Lyons, observer.]

Day.	May.		June.		July.		August.		September.		October.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	35	2.0	175	1.1	62	0.5	6	0.2	1	0.9	27
2	.....	35	2.3	225	1.15	70	.45	5	.2	1	.9	27
3	1.0	41	2.2	208	1.0	50	.4	4	.....	0	1.0	37
4	1.0	41	2.25	216	.9	40	.4	4	.....	0	.9	25
5	1.05	46	2.25	216	.8	25	.4	4	.....	0	.95	29
6	1.2	63	2.35	232	.8	25	.4	4	.....	0	1.2	52
7	1.4	87	2.35	232	.75	21	.4	4	.....	0	1.0	31
8	1.5	100	2.6	278	.65	13	.....	0	.....	0	.9	21
9	1.75	136	3.0	356	.5	7	.....	0	.....	0	.9	21
10	1.95	167	2.7	297	.5	7	.....	0	.....	0	.9	21
11	1.85	151	2.2	217	.5	6	.....	0	.....	0	.9	21
12	1.55	107	2.25	227	.5	6	.6	9	.....	0	.9	21
13	1.55	107	2.15	210	.5	6	.6	9	.6	9	.9	21
14	1.75	136	2.4	263	.7	13	.5	6	.6	9	.9	21
15	2.0	175	2.45	271	.7	13	.4	4	.6	9	.9	21
16	1.95	167	2.4	263	.7	13	.5	6	.65	11	.9	21
17	2.1	191	2.9	368	.7	13	.5	6	.7	13	.9	21
18	2.1	191	2.6	310	.65	11	.5	6	.7	13	.9	21
19	2.05	183	2.2	237	.6	9	.45	5	.6	9	.9	21
20	2.0	175	2.15	236	.6	9	.45	5	.6	9	.9	21
21	1.8	143	2.25	254	.6	9	.5	6	.6	9	.9	21
22	1.6	114	2.1	228	.6	9	.5	6	.6	9	.9	21
23	1.6	114	1.95	192	.6	9	.6	9	.6	9	.9	21
24	1.55	107	1.8	168	.6	9	.5	6	.6	9	.9	21
25	1.7	128	1.55	130	.6	9	.55	7.5	.6	9	.9	21
25	1.85	151	1.45	115	.55	7.5	.5	6	.6	9	.9	21
27	1.9	159	1.3	95	.5	6	.5	6	.6	9	.9	21
28	1.85	151	1.1	70	.5	6	.45	5	.7	13	.9	21
29	1.8	143	1.15	70	.5	6	.4	4	.7	13	.9	21
30	1.8	143	1.1	62	.5	6	.25	1.5	.7	13	.9	21
31	1.95	167	.....	.....	.5	6	.2	1	.....	.....	.9	21

NOTE.—Daily discharge determined as follows: May 3 to June 10, July 12 to Sept. 30, and Oct. 7 to 31 from rating curves poorly defined; all other periods by indirect method for shifting channels Channel dry Aug. 8 to 11 and Sept. 3 to 12.

Monthly discharge of Spring Creek near Saratoga, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	191	35	124	7,620	C.
June	368	62	214	12,700	C.
July	70	6	16.2	996	C.
August	9	0	4.7	289	C.
September	13	0	6.2	369	C.
October	52	21	23.6	1,450	C.
The period	.....	.....	.....	23,400	

JACK CREEK NEAR SARATOGA, WYO.

Location.—At Burdick's ranch, in sec. 28, T. 18 N., R. 84 W., about 5 miles northwest of Saratoga. There is no tributary between the station and the mouth, 1 mile below. There is no tributary for a distance of several miles above.

Records available.—April 26 to October 31, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Apparently permanent.

Discharge measurements.—Made from private bridge.

Winter flow.—Ice causes backwater during the winter months, and the records are discontinued.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions of 92 second-feet from Jack Creek. These diversions are all above the station.

Cooperation.—Station maintained in cooperation with the State engineer.

Discharge measurements of Jack Creek near Saratoga, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 26	Fletcher and Kingdon	1.55	37.9	June 20	R. H. Fletcher	1.72	54.1
May 28	R. H. Fletcher	1.65	45.2	July 13	do	.78	1.7
June 9	do	2.20	100	Oct. 6	G. H Russell	1.50	31.9

Daily gage height, in feet, of Jack Creek near Saratoga, Wyo., for 1911.

[Mrs A. E. Dahl, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1		1.68	1.70	0.92	0.60	0.60	0.95
2		1.62	1.70	.92	.60	.60	1.00
3		1.60	1.78	.98	.55	.60	1.00
4		1.62	1.72	.92	.55	.60	1.00
5		1.72	1.70	.95	.55	.60	1.10
6		1.92	1.70	.92	.55	.65	1.50
7		2.05	1.70	.90	.55	.65	1.30
8		2.00	1.70	.90	.55	.65	1.20
9		2.30	2.10	.82	.55	.60	1.10
10		2.30	2.05	.80	.55	.60	1.10
11		2.00	1.80	.78	.60	.60	1.10
12		1.90	1.72	.72	.60	.60	1.10
13		1.90	1.62	.68	.60	.60	1.05
14		2.05	1.65	.65	.60	.60	1.05
15		2.15	1.85	.65	.60	.60	1.05
16		2.15	2.30	.65	.60	.60	1.10
17		2.05	2.60	.65	.65	.65	1.05
18		1.95	1.95	.68	.60	.65	1.05
19		1.90	1.80	.70	.60	.65	1.05
20		1.85	1.70	.70	.60	.65	1.05
21		1.80	1.72	.70	.60	.65	1.05
22		1.65	1.68	.70	.60	.65	1.05
23		1.60	1.62	.70	.72	.65	1.05
24		1.65	1.52	.70	.70	.70	1.05
25		1.65	1.50	.70	.68	.70	1.05
26	1.58	1.70	1.48	.70	.60	.70	1.10
27	1.65	1.75	1.32	.68	.60	.90	1.10
28	1.68	1.68	1.15	.65	.60	.85	1.10
29	1.72	1.65	1.10	.62	.60	.80	1.10
30	1.70	1.60	.92	.60	.60	.85	1.10
31		1.65		.60	.60		1.10

Daily discharge, in second-feet, of Jack Creek near Saratoga, Wyo., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	47	49	4.6	0.5	0.5	5.5
2	.....	43	49	4.6	.5	.5	7.0
3	.....	41	56	6.4	.2	.5	7.0
4	.....	43	51	4.6	.2	.5	7.0
5	.....	51	49	5.5	.2	.5	11
6	.....	69	49	4.6	.2	.8	34
7	.....	82	49	4.0	.2	.8	21
8	.....	77	49	4.0	.2	.8	16
9	.....	111	88	2.4	.2	.5	11
10	.....	111	82	2.0	.2	.5	11
11	.....	77	58	1.8	.5	.5	11
12	.....	67	51	1.2	.5	.5	11
13	.....	67	43	.9	.5	.5	9.0
14	.....	82	45	.8	.5	.5	9.0
15	.....	94	62	.8	.5	.5	9.0
16	.....	94	111	.8	.5	.5	11
17	.....	82	149	.8	.8	.8	9.0
18	.....	72	72	.9	.5	.8	9.0
19	.....	67	58	1.0	.5	.8	9.0
20	.....	62	49	1.0	.5	.8	9.0
21	.....	58	51	1.0	.5	.8	9.0
22	.....	45	47	1.0	.5	.8	9.0
23	.....	41	43	1.0	1.2	.8	9.0
24	.....	45	35	1.0	1.0	1.0	9.0
25	.....	45	34	1.0	.9	1.0	9.0
26	40	49	33	1.0	.5	1.0	11
27	45	54	22	.9	.5	4.0	11
28	47	47	14	.8	.5	3.0	11
29	51	45	11	.6	.5	2.0	11
30	49	41	4.6	.5	.5	3.0	11
31	.....	45	.....	.5	.5	.....	11

NOTE.—Daily discharge determined from a fairly well-defined rating curve.

Monthly discharge of Jack Creek near Saratoga, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy
	Maximum.	Minimum.	Mean.		
April 26-30	.....	.....	46.4	460	B.
May	111	41	63.0	3,870	B.
June	149	4.6	52.1	3,100	B.
July	6.4	.5	2.00	123	C.
August	1.2	.2	.48	30	C.
September	4.0	.5	.98	58	C.
October	34	5.5	10.9	670	B.
November	.....	.....	*a* 8.00	476	D.
December	.....	.....	*a* 6.00	369	D.
The period	.....	.....	.....	9,160	

a Estimated.

PASS CREEK NEAR WALCOTT, WYO.

Location.—At Crone's ranch, 4 miles south of Walcott. There is no important tributary between the station and the mouth, several miles below.

Records available.—May 4 to October 4, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Apparently permanent.

Discharge measurements.—Made by wading.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions from Pass Creek of 155 second-feet, and from tributaries, 33 second-feet. It is probable that the greater part of the diversions is above the station.

Accuracy.—Conditions are favorable for accurate results, and the estimates should be reliable.

Cooperation.—Station maintained in cooperation with the State engineer.

Discharge measurements of Pass Creek near Walcott, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 4	Fletcher and Kingdon	2.05	20.6	June 19	R. H. Fletcher	3.00	88.9
28	R. H. Fletcher	2.30	39.9	July 10	do	1.28	[a] 1.0
June 9	do	1.90	17.3	Oct. 4	G. H. Russell	1.39	1.0

[a] Estimated.

Daily gage height, in feet, and discharge, in second-feet, of Pass Creek near Walcott, Wyo. for 1911.

[A. Crone, observer.]

Day.	May.		June.		July.		Day	May.		June.		July.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1		20	2.10	25	1.35	1.0	16		27	3.35	118	1.2	.0
2		20	2.2	31	1.3	.5	17		28	4.7	241	1.2	.0
3		21	2.2	31	1.3	.5	18		28	4.25	198	1.2	.0
4	2.05	22	2.15	28	1.3	.5	19		29	2.9	81	1.2	.0
5		22	2.0	20	1.3	.5	20		29	2.75	69	1.2	.0
6		22	1.95	18	1.3	.5	21		30	2.45	48	1.2	.0
7		23	1.95	18	1.3	.5	22		30	2.45	48	1.2	.0
8		23	1.9	15	1.25	.2	23		31	2.25	34	1.2	.0
9		24	1.9	15	1.2	.0	24		31	2.4	44	1.2	.0
10		24	2.3	37	1.25	.2	25		32	2.25	34	1.2	.0
11		25	2.05	22	1.25	.2	26		32	1.65	6.8	1.1	.0
12		25	1.95	18	1.25	.2	27		33	1.6	5.5	1.1	.0
13		26	2.25	34	1.2	.0	28	2.25	34	1.5	3.5		.0
14		26	2.2	31	1.2	.0	29	2.1	25	1.45	2.5		.0
15		27	1.6	5.5	1.2	.0	30	2.0	20	1.45	2.5		.0
							31	2.0	20				.0

NOTE.—Daily discharge determined from a rating curve fairly well defined below 90 second-feet. Discharge interpolated May 1 to 3 and May 5 to 27. No flow during August and September.

Monthly discharge of Pass Creek near Walcott, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	34	20	26.1	1,600	C.
June	241	2.5	42.8	2,550	B.
July	1	.0	.15	9.2	B.
August	.....	.....	0	0	
September	.....	.....	0	0	
The period	.....	.....	.....	4,160	

MEDICINE BOW RIVER NEAR MEDICINE BOW, WYO.

Location.—At Johnson's ranch, in sec. 7, T. 20 N., R. 79 W., 14 miles southwest of Medicine Bow. The nearest tributary enters 3 miles below.

Records available.—June 4 to November 4, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Slightly shifting.

Discharge measurements.—Made from bridge and by wading.

Winter flow.—Ice causes backwater during the winter months and the records are discontinued.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions from Medicine Bow River of 230 second-feet, a large portion of which are above the station.

Accuracy.—Conditions are favorable for good results and the estimates should be reliable.

Cooperation.—Station maintained in cooperation with the State engineer and with Johnson & Crownberg.

Discharge measurements of Medicine Bow River near Medicine Bow, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
June 4	Fletcher and Whiting.	6.90	676	June 28	J. A. Whiting	5.80	158
13	R. H. Fletcher	6.87	637	July 14	R. H. Fletcher	5.05	7.3
23	...do	6.50	492	Oct. 8	G. H. Russell	5.39	28.0

Daily gage height, in feet, of Medicine Bow River near Medicine Bow, Wyo., for 1911.

[Mrs. S. W. Johnson, observer.]

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	5.7	5.0	.....	5.22	5.27	16	7.6	5.15	4.8	4.82	5.52	.....
2	.....	5.75	5.0	.....	5.22	5.27	17	7.8	5.15	4.8	5.32	5.47	.....
3	.....	5.7	5.0	.....	5.32	5.27	18	7.6	5.15	4.8	5.32	5.42	.....
4	6.9	5.7	4.95	.....	5.32	5.27	19	7.1	5.15	4.75	5.32	5.42	.....
5	7.2	5.6	4.95	.....	5.42	.....	20	6.9	5.25	4.75	4.92	5.42	.....
6	7.2	5.55	4.95	.....	5.47	.....	21	6.9	5.25	4.75	4.92	5.37	.....
7	7.1	5.45	4.95	.....	5.72	.....	22	6.8	5.25	4.75	4.92	5.37	.....
8	7.05	5.35	4.9	4.82	5.67	.....	23	6.55	5.25	4.75	4.92	5.37	.....
9	7.8	5.35	4.9	4.82	5.67	.....	24	6.45	5.25	4.85	4.92	5.37	.....
10	6.7	5.35	4.9	4.82	5.62	.....	25	6.3	5.2	4.85	4.97	5.37	.....
11	6.85	5.35	4.9	4.82	5.62	.....	26	6.15	5.15	4.85	5.07	5.32	.....
12	6.85	5.3	4.85	4.82	5.62	.....	27	6.0	5.15	4.85	5.17	5.32	.....
13	6.9	5.25	4.85	4.82	5.57	.....	28	5.9	5.1	4.95	5.27	5.32	.....
14	6.9	5.2	4.85	4.82	5.57	.....	29	5.8	5.1	4.9	5.27	5.32	.....
15	6.95	5.15	4.8	4.82	5.57	.....	30	5.75	5.05	.....	5.27	5.32	.....
							31	.....	5.05	.....	.....	5.27	.....

NOTE.—Channel dry Aug. 30 to Sept. 7.

Daily discharge, in second-feet, of Medicine Bow River near Medicine Bow, Wyo., for 1911.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	128	5.0	0.0	18	10	16	1,080	14	1.0	1.2	42	.....
2	.....	145	5.0	.0	18	10	17	1,200	14	1.0	36	35	.....
3	.....	128	5.0	.0	25	10	18	1,080	14	1.0	36	28	.....
4	680	128	3.5	.0	25	10	19	790	14	.0	36	28	.....
5	845	98	3.5	.0	35	.....	20	680	26	.0	2.6	28	.....
6	845	85	3.5	.0	40	.....	21	680	26	.0	2.6	22	.....
7	790	61	3.5	.0	95	.....	22	626	26	.0	2.6	22	.....
8	762	41	2.0	1.2	70	.....	23	496	26	.0	2.6	22	.....
9	1,200	41	2.0	1.2	70	.....	24	445	26	1.5	2.6	22	.....
10	573	41	2.0	1.2	60	.....	25	372	19	1.5	4.1	22	.....
11	653	41	2.0	1.2	60	.....	26	304	14	1.5	8.5	16	.....
12	653	32	1.5	1.2	60	.....	27	240	14	1.5	16	16	.....
13	680	26	1.5	1.2	50	.....	28	200	10	3.5	28	16	.....
14	680	19	1.5	1.2	50	.....	29	162	10	2.0	28	16	.....
15	708	14	1.0	1.2	50	.....	30	145	7.5	.0	28	16	.....
							31	.....	7.5	.0	.....	10	.....

NOTE.—Daily discharge determined as follows: June 4 to Sept. 30 from fairly well defined rating curve; Oct. 9 to Nov. 4, curve poorly defined; Oct. 1 to 8, by indirect method for shifting channels.

Monthly discharge of Medicine Bow River near Medicine Bow, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
June 4–30	1,200	145	651	34,900	B.
July	145	7.5	41.8	2,570	B.
August	5.0	.0	1.84	113	B.
September	36	.0	8.15	485	B.
October	95	10	35.1	2,160	C.
November	.....	.....	[a] 10	595	D.
December	.....	.....	[a] 10	615	D.
The period	.....	.....	.....	41,400	

[a] Estimated.

ROCK CREEK NEAR ARLINGTON, WYO.

Location.—At highway bridge in sec. 25, T. 19 N., R. 79 W., 1½ miles upstream from Arlington post office; 1 mile below the mouth of Overland Creek, the nearest tributary.

Records available.—April 22 to November 4, 1911.

Drainage area.—70 square miles (measured from Forest Service Atlas).

Gage.—Vertical staff.

Channel.—Shifting.

Discharge measurements.—Made from bridge.

Winter flow.—Ice causes backwater during the winter months and the records are discontinued.

Diversions.—One small ditch diverts water above the station for irrigation.

Accuracy.—As the channel shifts the estimates have been obtained by the indirect method and can be considered only fair except for those months when the measurements indicated no shift, when they are probably good.

Cooperation.—Station maintained in cooperation with the State engineer and the Rock Creek Conservation Co.

Discharge measurements of Rock Creek near Arlington, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 26	Fletcher and Whiting	2.80	486	July 9	Fletcher and Cummings	1.60	98.5
June 3	do	3.10	686	23	F. T. Cummings	1.40	61.8
7	Fletcher and Cummings	3.45	995	Aug. 22	do	1.20	28.8
18	Fletcher and Whiting	2.60	465	Nov. 3	do	1.30	23.5
27	J. A. Whiting	2.30	200				

Daily gage height, in feet, of Rock Creek near Arlington, Wyo., for 1911.

[Leon Clearwater, observer.]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.5	3.1	2.2	1.4	1.2	1.1	1.4
2	.....	1.4	3.4	2.1	1.4	1.1	1.2	1.4
3	.....	1.4	3.1	1.9	1.4	1.2	1.1	1.4
4	.....	1.5	3.2	1.8	1.3	1.2	1.1	1.3
5	.....	1.6	3.3	1.8	1.4	1.1	1.1	.....
6	.....	1.6	3.5	1.8	1.4	1.3	1.2	.....
7	.....	1.9	3.9	1.7	1.3	1.2	1.3	.....
8	.....	2.0	3.6	1.8	1.3	1.1	1.3	.....
9	.....	2.4	3.1	1.6	1.3	1.1	1.4	.....
10	.....	2.5	2.9	1.6	1.4	1.0	1.4	.....
11	.....	2.0	2.8	1.6	1.3	1.0	1.3	.....
12	.....	2.2	2.7	1.7	1.3	1.0	1.4	.....
13	.....	2.2	2.9	1.6	1.2	1.0	1.4	.....
14	.....	2.3	3.0	1.6	1.3	1.0	1.4	.....
15	.....	2.3	3.1	1.5	1.3	1.0	1.4	.....
16	.....	2.5	3.3	1.6	1.2	1.1	1.4	.....
17	.....	2.6	3.6	1.6	1.1	1.1	1.4	.....
18	.....	2.7	2.8	1.5	1.2	1.2	1.4	.....
19	.....	2.8	2.8	1.6	1.1	1.1	1.5	.....
20	.....	2.4	3.0	1.5	1.2	1.1	1.4	.....
21	.....	2.3	3.1	1.4	1.1	1.1	1.4	.....
22	1.1	2.2	2.8	1.4	1.2	1.0	1.4	.....
23	1.2	2.3	2.6	1.4	1.3	1.1	1.4	.....
24	1.2	2.4	2.5	1.4	1.2	1.1	1.4	.....
25	1.3	2.5	2.4	1.4	1.2	1.1	1.4	.....
26	1.3	2.8	2.2	1.4	1.2	1.1	1.4	.....
27	1.4	2.9	2.2	1.4	1.15	1.0	1.4	.....
28	1.5	2.5	2.4	1.4	1.1	1.0	1.4	.....
29	1.6	2.6	2.5	1.3	1.1	1.0	1.4	.....
30	1.5	2.9	2.3	1.4	1.1	1.1	1.4	.....
31	.....	3.0	.....	1.4	1.2	.....	1.3	.....

Daily discharge, in second-feet, of Rock Creek near Arlington, Wyo., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	72	690	195	57	33	24	35
2	.....	57	950	170	57	24	33	35
3	.....	57	690	140	57	33	24	35
4	.....	72	770	120	44	33	24	26
5	.....	89	860	120	57	24	24	.....
6	.....	89	1,050	127	57	44	33	.....
7	.....	148	1,450	107	44	33	44	.....
8	.....	171	1,150	127	44	24	44	.....
9	.....	294	690	89	44	24	57	.....
10	.....	335	590	89	57	17	57	.....
11	.....	171	520	89	44	17	40	.....
12	.....	226	460	107	44	17	52	.....
13	.....	226	600	89	33	17	52	.....
14	.....	258	700	89	44	17	52	.....
15	.....	258	780	72	44	17	52	.....
16	.....	335	1,000	89	33	24	52	.....
17	.....	380	1,310	89	24	24	52	.....
18	.....	430	590	72	33	33	52	.....
19	.....	490	590	89	24	24	64	.....
20	.....	294	640	72	33	24	52	.....
21	.....	258	720	57	24	24	43	.....
22	24	226	510	57	33	17	43	.....
23	33	258	340	57	44	24	43	.....
24	33	294	300	57	33	24	43	.....
25	44	335	270	57	33	24	43	.....
26	44	490	175	57	33	24	43	.....
27	57	550	175	57	28	17	43	.....
28	72	335	230	57	24	17	43	.....
29	89	380	265	44	24	17	43	.....
30	72	550	220	57	24	24	43	.....
31	.....	620	.....	57	33	.....	33	.....

NOTE.—Daily discharge determined as follows: Apr. 22 to June 7 and July 10 to Oct. 5, from poorly defined rating curve; June 8 to July 9 and Oct. 6 to Nov. 4, by indirect method for shifting channels.

Monthly discharge of Rock Creek near Arlington, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
Apr. 22-30	89	24	52.0	928	C.
May	620	57	282	17,300	C.
June	1,450	175	643	38,300	C.
July	195	44	88.9	5,470	C.
August	57	24	38.9	2,390	C.
September	44	17	23.8	1,420	C.
October	64	24	43.5	2,670	C.
The period				68,500	

ROCK CREEK NEAR ROCK RIVER, WYO.

Location.—At Phelan's ranch, in sec. 6, T. 20 N., R. 76 W., 1 mile southeast of Rock River. No important tributary between the station and the mouth, several miles below.

Records available.—March 25 to December 31, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Shifting.

Discharge measurements.—Made from private bridge during high water and by wading at ordinary stages.

Winter flow.—Ice causes backwater during the winter months.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions from Rock Creek of 232 second-feet, and from tributaries, 73 second-feet, chiefly above the station.

Accuracy.—As the channel shifts the estimates have been obtained by the indirect method and can be considered only fair.

Cooperation.—Station maintained in cooperation with the State engineer and the Rock Creek Conservation Co.

Discharge measurements of Rock Creek near Rock River, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 26	Fletcher and Whiting	1.60	200	June 25	Whiting and Cummings	1.60	238
June 2	do	2.40	568	July 8	Fletcher and Whiting	.70	24.2
8	Fletcher and Cummings	2.80	762	22	F. T. Cummings	.50	18.0
17	Fletcher and Whiting	3.30	896	Nov. 4	do	.80	[a] 10.0

[a] Estimated.

Daily gage height, in feet, of Rock Creek near Rock River, Wyo., for 1911.

[E. E. Clark, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		0.8	0.4	2.0	1.2	0.2		0.3	0.6	0.9
2		.8	.4	2.3	1.2	.2		.3	[illegible]	.9
3		.8	.4	2.2	1.2	.3		.3	.8	.9
4		.7	.5	2.45	1.2	.4		.4	.8	.9
5		.7	.4	2.5	1.1	.4		.4	.8	.9
6		.7	.4	2.4	1.0	.4		.3	.8	.9
6		.6	.4	3.0	1.0	.4		.3	.8	.9
8		.5	.4	3.0	1.0	.4		.3	.8	.9
9		.5	.6	2.9	.9	.4		.4	.8	.9
10		.5	.8	2.5	.8	.4		.4	.8	.9

Daily gage height, in feet, of Rock Creek near Rock River, Wyo., for 1911—Continued.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	.....	0.5	1.0	2.0	.8	0.4	.....	0.4	0.8	0.9
12	.....	.3	1.0	2.0	.8	.4	.....	.4	.8	.9
13	.....	.3	1.0	2.1	.8	.3	.....	.4	8	.9
14	.....	.3	1.1	2.1	.7	.3	.....	.4	.8	.9
15	.....	.3	1.1	2.0	.7	.2	.....	.4	.8	.9
16	.....	.3	1.3	3.0	.7	.4	.....	.4	.8	.9
17	.....	.3	1.4	3.3	.7	.6	.....	.4	.8	.9
18	.....	.3	1.5	2.0	.8	.6	.....	.3	.8	.9
19	.....	.3	1.5	2.0	.7	.6	.....	.....	.8	.9
20	.....	.3	1.5	2.0	.7	.6	.....	.3	.8	.9
21	.....	.3	1.4	2.95	.6	.6	.....	.4	.8	.9
22	.....	.4	1.4	2.85	.6	.6	.....	.4	.8	.9
23	.....	.4	1.4	2.0	.6	.5	.....	.5	.8	.9
24	.....	.4	1.4	1.5	.6	.5	.....	.5	.8	.9
25	1.3	.4	1.4	1.5	.3	.4	.....	.5	.8	.9
26	1.3	.4	1.6	1.5	.....	.4	0.1	.5	.9	.9
27	1.4	.3	1.7	1.3	.....	.3	.1	.5	.9	.9
28	1.5	.4	1.5	1.3	.....	.2	.2	.5	.9	.9
29	1.3	.4	1.5	1.2	.....	.....	.3	.5	.9	.9
30	1.0	.4	1.6	1.2	.2	.....	.3	.5	.9	.9
31	.8	.....	2.0	.....	.2	.....	.....	.6	.....	.9

NOTE.—Channel dry July 26–29 and Aug. 29 to Sept. 25. River frozen over Nov. 2 to Dec. 31. Gage heights were read to top of ice and do not represent the discharge.

Daily discharge, in second-feet, of Rock Creek near Rock River, Wyo., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	37	3	383	110	4	0	7	25
2	.....	37	3	515	110	4	0	7	.....
3	.....	37	3	470	110	7	0	7	.....
4	.....	25	8	584	110	11	0	11	.....
5	.....	25	3	607	90	11	0	11	.....
6	.....	25	3	560	67	11	0	7	.....
7	.....	15	3	857	67	11	0	7	.....
8	.....	8	3	857	67	11	0	7	.....
9	.....	8	15	800	51	11	0	11	.....
10	.....	8	37	580	37	11	0	11	.....
11	.....	8	67	360	37	11	0	11	.....
12	.....	1	67	360	45	11	0	11	.....
13	.....	1	67	380	45	7	0	11	.....
14	.....	1	85	380	30	7	0	11	.....
15	.....	1	85	340	30	4	0	11	.....
16	.....	1	127	780	37	11	0	11	.....
17	.....	1	151	900	37	25	0	11	.....
18	.....	1	176	305	52	25	0	7	.....
19	.....	1	176	330	37	25	0	7	.....
20	.....	1	176	330	35	25	0	7	.....
21	.....	1	151	780	25	25	0	11	.....
22	.....	3	151	730	25	25	0	11	.....
23	.....	3	151	370	25	17	0	17	.....
24	.....	3	151	200	25	17	0	17	.....
25	127	3	151	210	7	11	0	17	.....
26	127	3	202	210	7	11	1	17	.....
27	151	1	229	140	6	7	1	17	.....
28	176	3	190	140	5	4	4	17	.....
29	127	3	190	120	4	0	7	17	.....
30	67	3	230	120	4	0	7	17	.....
31	37	.....	360	.....	4	0	.....	25	.....

NOTE.—Daily discharge determined as follows: June 3–8 and July 23 to Nov. 1, from fairly well defined rating curve; Mar. 25 to May 26 from a poorly defined rating curve; all other periods by indirect method for shifting channels.

Monthly discharge of Rock Creek near Rock River, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 25-31	176	37	116	1,610
April	37	1	8.9	530
May	360	3	110	6,760
June	900	120	457	27,200
July	110	4	43.2	2,660
August	25	0	11.6	713
September	7	0	.7	42
October	25	7	11.8	726
The period				40,200

BOXELDER CREEK NEAR CAREYHURST, WYO.

Location.—At highway bridge in sec. 7, T. 33 N., R. 73 W., 1 mile south of Careyhurst. No tributary between the station and the mouth, 1 mile below. The nearest tributary is a small stream about 2 miles above.

Records available.—May 17 to October 31, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Data too meager to determine.

Discharge measurements.—Made from bridge.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions from Boxelder Creek of 51 second-feet, and from the tributaries, 46 second-feet. All these diversions are above the station.

Accuracy.—As only three discharge measurements have been made the estimates of flow can be considered only fair.

Cooperation.—Station maintained in cooperation with the State engineer.

Discharge measurements of Boxelder Creek near Careyhurst, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 18	R. H. Fletcher	3.00	105
June 21	E. O. Christiansen	2.81	80.0
Oct. 13	G. H. Russell	2.06	2.7

Daily gage height, in feet, of Boxelder Creek near Careyhurst, Wyo., for 1911.

[R. D. Moffett, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	2.6	2.25	1.9	1.9	1.9	16	.....	2.5	1.9	1.9	1.9	2.1
2	.....	2.6	2.1	1.9	1.9	1.9	17	3.0	3.15	1.9	1.9	1.9	2.1
3	.....	2.55	2.05	1.9	1.9	1.9	18	3.0	2.9	2.0	1.9	1.9	2.2
4	.....	2.35	1.95	1.9	1.9	1.95	19	3.0	2.75	2.0	1.9	1.9	2.2
5	.....	2.25	1.9	1.9	1.9	1.9	20	3.0	2.75	2.0	1.9	1.9	2.2
6	.....	2.15	1.9	2.0	1.9	1.9	21	2.9	2.8	2.3	1.9	1.9	2.2
7	.....	2.1	1.9	1.95	1.9	1.9	22	2.9	2.75	2.1	1.9	1.9	2.2
8	.....	2.1	1.9	1.9	1.9	2.05	23	2.8	2.7	2.05	1.9	1.9	2.2
9	.....	2.2	1.9	1.9	1.9	2.05	24	2.7	2.65	1.95	1.9	1.9	2.2
10	.....	2.15	1.9	1.9	1.9	2.05	25	2.65	2.6	1.9	1.9	1.9	2.3
11	.....	2.1	1.9	1.9	1.9	2.0	26	2.6	2.6	1.9	1.9	1.9	2.3
12	.....	2.0	1.9	1.9	1.9	2.0	27	2.6	2.5	1.9	1.9	1.9	2.3
13	.....	2.0	1.9	1.9	1.9	2.0	28	2.6	2.45	1.9	1.9	1.9	2.3
14	.....	2.0	1.9	1.9	1.9	2.0	29	2.6	2.35	1.9	1.9	1.9	2.3
15	.....	2.0	1.9	1.9	1.9	2.1	30	2.6	2.3	1.9	1/9	1.9	2.3
							31	2.6	.....	1.9	1.9	.....	2.3

Daily discharge, in second-feet, of Boxelder Creek near Careyhurst, Wyo., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	54	16	0.0	0.0	0.0	16	.....	42	0.0	0.0	0.0	4.5
2	.....	54	4.5	.0	.0	.0	17	105	126	.0	.0	.0	4.5
3	.....	48	3.0	.0	.0	.0	18	105	92	1.5	.0	.0	11
4	.....	26	.8	.0	.0	.8	19	105	72	1.5	.0	.0	11
5	.....	16	.0	.0	.0	.0	20	105	72	1.5	.0	.0	11
6	.....	7.8	.0	1.5	.0	.0	21	92	79	20	.0	.0	11
7	.....	4.5	.0	.8	.0	.0	22	92	72	4.5	.0	.0	11
8	.....	4.5	.0	.0	.0	3.0	23	79	66	3.0	.0	.0	11
9	.....	11	.0	.0	.0	3.0	24	66	60	.8	.0	.0	11
10	.....	7.8	.0	.0	.0	3.0	25	60	54	.0	.0	.0	20
11	.....	4.5	.0	.0	.0	1.5	26	54	54	.0	.0	.0	20
12	.....	1.5	.0	.0	.0	1.5	27	54	42	.0	.0	.0	20
13	.....	1.5	.0	.0	.0	1.5	28	54	36	.0	.0	.0	20
14	.....	1.5	.0	.0	.0	1.5	29	54	26	.0	.0	.0	20
15	.....	1.5	.0	.0	.0	4.5	30	54	20	.0	.0	.0	20
							31	54	.....	.0	.0	.....	20

NOTE.—Daily discharge determined from a fairly well-defined rating curve.

Monthly discharge of Boxelder Creek near Caryhurst, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May 17-31	105	54	75.5	2,250	C.
June	126	1.5	38.6	2,300	C.
July	20	.0	1.84	113	C.
August	1.5	.0	.07	4.3	C.
September	.0	.0	.00	.0	C.
October	20	.0	7.92	487	C.
November	.....	.....	[a] 12	714	D.
December	.....	.....	[a] 8	492	D.
The period	.....	.....	.....	6,360	

[a] Estimated.

LARAMIE RIVER AT GLENDEVEY, COLO.

Location.—At highway bridge one-eighth mile west of Glendevey in sec. 36, T. 10 N., R. 76 W., in the Medicine Bow National Forest; McIntyre Creek enters a short distance below and Spring Creek above.

Records available.—June 24, 1904, to October 31, 1905; August 18, 1910, to November 30, 1911.

Drainage area.—102 square miles [1] (measured from Clason's 1911 sectional map of Colorado).

Gage.—Automatic gage installed by the State engineer November 17, 1910, replaced vertical staff previously used. The datum of the gages has remained constant.

Channel.—Permanent.

Discharge measurements.—Made from cable at bridge during high water and by wading at ordinary stages.

Winter flow.—Ice causes backwater during the winter months.

Diversions.—There are court decrees for diversions of 65 second-feet from Laramie River above the station and for 749 second-feet from tributaries entering above. Of this latter amount 688 second-feet are for diversion into the Cache La Poudre basin.

[1] Revised since previous reports.

Accuracy.—Conditions are favorable for excellent results, and the estimates should be reliable.

Cooperation.—Since its reestablishment the station has been maintained in cooperation with the State engineer and the United States Forest Service.

Discharge measurements of Laramie River at Glendevey, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 14	C. E. Turner	2.90	288	Aug. 20	C. E. Turner	2.04	41.4
July 8	do	2.78	232	Sept. 17	do	1.84	23.1
18	do	2.30	88.2	Oct. 7	do	2.12	53.4
23	do	2.35	96.0	18	C. C. Hezmalhalch	1.95	30.1
Aug. 18	do	2.00	36.1				

Daily gage height, in feet, of Laramie River at Glendevey, Colo., for 1911.

[Albert L. Fairhuret, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.75	1.6	1.8	1.85	2.3	3.25	2.6	2.1	1.9	2.3	1.7
2	1.8	1.6	1.8	1.9	2.25	3.35	2.85	2.1	1.9	2.15	1.75
3	1.9	1.7	1.7	1.95	2.25	3.25	2.85	2.1	1.9	2.1	1.75
4	1.85	1.8	1.75	1.95	2.3	3.25	2.9	2.1	1.95	2.05	1.8
5	1.75	1.8	1.8	1.9	2.5	3.3	2.85	2.1	1.9	2.15	1.8
6	1.85	1.75	1.8	1.9	2.5	3.3	2.85	2.05	1.95	2.3	1.75
7	1.8	1.7	1.8	1.75	2.65	3.45	2.85	2.05	1.9	2.25	1.85
8	1.7	1.6	1.8	1.8	2.85	3.35	2.7	2.0	1.9	2.2	1.85
9	1.65	1.65	1.8	1.9	3.0	3.65	2.7	2.0	1.9	2.1	1.85
10	1.65	1.75	1.8	1.9	2.9	3.25	2.45	2.0	1.85	2.05	1.9
11	1.6	1.8	1.8	1.9	2.65	3.2	2.3	2.05	1.8	1.95	1.9
12	1.7	1.75	1.8	1.85	2.7	3.2	2.25	2.05	1.8	1.9	1.9
13	1.8	1.6	2.0	1.75	2.8	3.2	2.35	2.0	1.8	1.9	1.9
14	1.7	1.5	1.95	1.65	2.85	3.25	2.55	2.0	1.85	1.9	1.85
15	1.7	1.5	1.95	1.7	3.05	3.4	2.4	1.95	1.9	1.7	1.85
16	1.7	1.55	1.8	1.85	3.15	3.5	2.35	1.95	1.85	1.85	1.9
17	1.7	1.75	1.75	2.0	3.15	3.5	2.35	2.0	1.85	1.95	1.85
18	1.75	1.85	1.8	1.95	3.1	3.3	2.3	2.0	1.8	1.9	1.85
19	1.75	1.7	1.8	2.05	2.85	3.2	2.45	2.05	1.85	1.9	1.85
20	1.7	1.6	1.8	2.0	2.6	3.4	2.35	2.0	1.85	1.9	1.8
21	1.7	1.6	1.8	2.1	2.5	3.8	2.3	2.05	1.85	1.9	1.8
22	1.7	1.6	1.8	2.2	2.6	3.7	2.25	2.0	1.9	1.9	1.75
23	1.75	1.6	1.7	2.1	2.65	3.7	2.35	2.15	2.15	1.9	1.8
24	1.75	1.65	1.8	2.1	2.85	3.6	2.3	2.0	1.95	1.9	1.75
25	1.75	1.7	1.85	2.25	2.9	3.2	2.25	2.0	1.9	1.8	1.8
26	1.75	1.65	1.9	2.3	2.85	2.9	2.25	1.95	1.85	1.75	1.8
27	1.8	1.6	1.8	2.3	3.0	2.9	2.25	1.9	1.9	1.8	1.7
28	1.85	1.6	1.8	2.25	3.0	2.75	2.25	1.9	1.95	1.8	.....
29	1.8	.....	1.9	2.2	3.05	2.7	2.2	1.9	1.95	1.8	.....
30	1.75	.....	1.85	2.2	3.05	2.65	2.15	1.85	2.05	1.75	.....
31	1.65	.....	1.7	.....	3.15	.....	2.1	1.85	.....	1.75	.....

Daily discharge, in second-feet, of Laramie River at Glendevey, Colo., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	16	10	19	22	84	461	166	49	26	84	14
2	19	10	19	26	74	517	264	49	26	57	16
3	26	14	14	31	74	461	264	49	26	49	16
4	22	19	16	31	84	461	285	49	31	42	19
5	16	19	19	26	135	488	264	49	26	57	19
6	22	16	19	26	135	488	264	42	31	84	16
7	19	14	19	16	184	576	264	42	26	74	22
8	14	10	19	19	264	517	201	36	26	65	22
9	12	12	19	26	332	705	201	36	26	49	22
10	12	16	19	26	285	461	122	36	22	42	26

Daily discharge, in second-feet, of Laramie River at Glendevey, Colo., for 1911—Contd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
11	10	19	19	26	184	434	84	42	19	31	26
12	14	16	19	22	201	434	74	42	19	26	26
13	19	10	36	16	242	434	96	36	19	26	26
14	14	8	31	12	264	461	150	36	22	26	22
15	14	8	31	14	357	546	108	31	26	14	22
16	14	9	19	22	408	606	96	31	22	22	26
17	14	16	16	36	408	606	96	36	22	31	22
18	16	22	19	31	382	488	84	36	19	26	22
19	16	14	19	42	264	434	122	42	22	26	22
20	14	10	19	36	166	546	96	36	22	26	19
21	14	10	19	49	135	812	84	42	22	26	19
22	14	10	19	65	166	740	74	36	26	26	16
23	16	10	14	49	184	740	96	57	57	26	19
24	16	12	19	49	264	670	84	42	31	26	16
25	16	14	22	74	285	434	74	36	26	19	19
26	16	12	26	84	264	285	74	31	22	16	19
27	19	10	19	84	332	285	74	26	26	19	14
28	22	10	19	74	332	222	74	26	31	19	15
29	19	.....	26	65	357	201	65	26	31	19	15
30	16	.....	22	65	357	184	57	22	42	16	15
31	12	.....	14	.....	408	.....	49	22	.....	16	.....

NOTE.—Daily discharge determined from a rating curve well defined between 5 and 450 second-feet. Discharge estimated Nov. 27 to 30. Ice present Nov. 27 to Dec. 31.

Monthly discharge of Laramie River at Glendevey, Colo., for 1911.

[Drainage area, 102 square miles.]

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	26	10	16.2	998	A.
February	22	8	12.9	607	A.
March	36	14	20.3	1,250	A.
April	84	12	38.8	2,310	A.
May	408	74	246	15,100	A.
June	812	184	490	29,200	A.
July	285	49	132	8,140	A.
August	57	22	37.8	2,320	A.
September	57	19	26.4	1,570	A.
October	84	14	35	2,150	A.
November	26	14	19.7	1,170	A.
December	.....	.....	[a] 12	738	D.
The year	812	8.0	98.0	65,600	

[a] Estimated.

LARAMIE RIVER NEAR JELM, WYO.

Location.—At highway bridge in sec. 15, T. 12 N., R. 77 W., 4 miles south of Jelm post office, one-fourth mile below the Colorado-Wyoming line.

Records available.—May 7 to November 30, 1911. From June 22, 1904, to October 31, 1905, a station was maintained at Decker's ranch, half a mile south of the State line. The records at the two stations are practically comparable as there are no tributaries nor diversions of any amount between.

Drainage area.—365 square miles (Clason's 1911 sectional map of Colorado).

Gage.—In 1911 an automatic recording gage was installed by the State engineer of Colorado. This is referred to the same datum as the vertical staff used at first.

Channel.—Practically permanent.

Discharge measurements.—Made from bridge.

Winter flow.—Ice causes backwater during the winter months and the records are discontinued.

Diversions.—Between this station and that at Glendevey, Colo., there are court decrees for diversions of 236 second-feet from Laramie River and 204 second-feet from intervening tributaries. These diversions are all in Colorado.

Accuracy.—Conditions are favorable for accurate results, and the estimates should be excellent.

Cooperation.—Station maintained in cooperation with the State engineers of Colorado and Wyoming.

Discharge measurements of Laramie River near Jelm, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 7	Fletcher and Kingdon	2.15	382	July 14	C. E. Turner	1.83	254
15	C. E. Turner	2.60	677	15	R. H. Fletcher	1.60	197
June 6	R. H. Fletcher	3.00	1,060	20	C. E. Turner	1.60	182
15	do	2.80	890	Aug. 19	do	1.14	65.2
24	do	2.35	556	22	do	1.19	75.1
July 10	C. E. Turner	1.75	225	Sept. 19	B. S. Clayton	1.00	45.3
14	do	1.99	309	Oct. 8	C. E. Turner	1.31	93.0

Daily gage height, in feet, of Laramie River near Jelm, Wyo., for 1911.

[Mrs. C. D. Oviatt, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.80	1.85	1.30	1.00	1.30	1.05
2	.....	2.90	2.30	1.30	1.00	1.30	1.05
3	.....	2.90	2.30	1.30	1.00	1.15	1.15
4	.....	2.85	2.10	1.30	1.05	1.10	1.20
5	.....	2.95	2.20	1.30	1.05	1.20	1.20
6	.....	2.90	2.20	1.25	1.00	1.45	1.30
7	2.15	2.85	2.05	1.20	1.00	1.35	1.30
8	2.35	2.95	2.00	1.20	1.00	1.25	1.25
9	2.50	3.15	1.85	1.15	1.00	1.20	1.20
10	2.60	2.80	1.70	1.20	1.00	1.20	1.20
11	2.20	2.75	1.40	1.25	.95	1.20	1.05
12	2.20	2.75	1.50	1.30	.95	1.15	1.10
13	2.40	2.70	1.55	1.20	.95	1.10	1.10
14	2.55	2.70	1.85	1.10	.95	1.10	1.20
15	2.65	2.70	1.70	1.00	1.00	1.15	.....
16	2.70	3.00	1.60	1.10	1.00	1.10	.....
17	2.75	3.00	1.65	1.20	1.00	1.15	.....
18	2.80	2.65	1.60	1.20	1.00	1.15	.....
19	2.70	2.55	1.55	1.15	.95	1.10	.....
20	2.50	2.85	1.60	1.15	.95	1.10	.....
21	2.30	2.85	1.55	1.20	1.00	1.15	.....
22	2.25	2.75	1.60	1.20	1.00	1.15	.....
23	2.25	2.50	1.55	1.35	1.15	1.10	.....
24	2.45	2.40	1.50	1.20	1.20	1.10	.....
25	2.60	2.30	1.45	1.15	1.00	1.10	.....
26	2.75	2.15	1.45	1.15	.95	1.10	.....
27	2.55	2.05	1.40	1.05	.90	1.15	.....
28	2.55	2.00	1.40	1.00	.90	1.10	.....
29	2.60	1.95	1.40	1.05	.90	1.10	.....
30	2.65	1.90	1.35	1.00	1.00	1.10	.....
31	2.75	.....	1.35	1.00	.....	1.10	.....

NOTE.—Gage heights distorted by ice Nov. 15 to Dec. 31.

Daily discharge, in second-feet, of Laramie River near Jelm, Wyo., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	877	278	94	43	94	56
2	.....	965	492	94	43	94	50
3	.....	970	488	94	43	65	65
4	.....	972	378	94	50	56	74
5	.....	1,020	428	94	50	74	74
6	.....	978	423	84	43	132	94
7	387	933	348	74	43	106	94
8	497	1,020	323	74	43	84	84
9	592	1,210	260	65	43	74	74
10	665	888	207	74	43	74	74
11	412	845	118	84	38	74	50
12	412	845	145	94	38	65	56
13	527	803	160	74	38	56	56
14	628	803	260	56	38	56	60
15	700	803	198	43	43	65	60
16	745	1,070	194	56	43	56	60
17	790	1,070	205	74	43	65	60
18	833	765	184	74	43	65	60
19	760	690	165	65	38	56	60
20	610	933	175	65	38	56	60
21	485	933	160	74	43	65	60
22	458	846	175	74	43	65	55
23	460	653	160	106	65	56	55
24	590	583	145	74	74	56	55
25	705	515	132	65	43	56	55
26	820	425	132	65	38	56	55
27	670	370	118	50	33	65	55
28	673	345	118	43	33	56	55
29	712	323	118	50	33	56	55
30	753	300	106	43	43	56	55
31	833	.....	106	43	.....	56	.....

NOTE.—Daily discharge determined from two rating curves well defined between 25 and 1,250 second-feet; indirect method for shifting channels was used from May 16 to June 6, June 25 to July 10, and July 15–20; discharge estimated Nov. 15 to 30. Ice present Nov. 15 to Dec. 31.

Monthly discharge of Laramie River near Jelm, Wyo., for 1911.

[Drainage area, 365 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
May 7–31	833	387	629	1.72	1.60	31,200	A.
June	1,210	300	792	2.17	2.42	47,100	A.
July	492	106	223	.611	.70	13,700	A.
August	106	43	71.4	.196	.23	4,390	A.
September	74	33	43.1	.118	.13	2,560	A.
October	132	56	68.1	.187	.22	4,180	A.
November	94	50	62.3	.171	.19	3,710	B.
December	.....	.....	[a] 50	.137	.16	3,070	D.
The period	.....	.....	.....	.....	.....	110,000	

[a] Estimated.

LARAMIE RIVER AT WOODS LANDING, WYO.

Location.—At highway bridge at Woods Landing, in sec. 11, T. 13 N., R. 77 W., a short distance below the mouth of Wood Creek, the nearest tributary.

Records available.—May 7 to November 11, 1911. During 1889, 1890, and 1891 a station was maintained at Woods Landing by the State engineer, and the results were published in his reports. From April 12, 1896, to September 30, 1909, a station was maintained at a point 400 feet above the present site, and as no streams intervene nor ditches divert water the records at the two points are comparable.

Drainage area.—Not measured.

Gage.—Vertical staff; no determined relation between present gage and gages used prior to 1900.

Channel.—A short distance below the bridge there is a diversion dam which is the control point for the station. As this dam is not permanent conditions are somewhat changeable.

Discharge measurements.—Made from bridge during high stages and by wading at ordinary stages.

Winter flow.—Ice causes backwater during the winter months and the records are discontinued.

Diversions.—Practically no water is diverted between the stations near Jelm and Woods Landing.

Cooperation.—During 1911 station was maintained in cooperation with the State engineer.

Discharge measurements of Laramie River at Woods Landing, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 7	Fletcher and Kingdon.	2.35	427	June 24	R. K. Fletcher	2.14	587
June 6	R. K. Fletcher	2.74	1,060	July 15	...do	1.54	196
15	...do	2.54	927	Oct. 9	G. H. Russell	1.66	84.5

Daily gage height, in feet, of Laramie River at Woods Landing, Wyo., for 1911.

[Bessie Summers, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.80	1.55	1.58	1.05	1.82	1.35
2	.....	2.82	1.62	1.50	1.02	1.92	1.22
3	.....	2.80	1.90	1.42	1.10	1.82	1.20
4	.....	2.78	1.90	1.40	1.20	1.68	1.18
5	.....	2.92	1.85	1.40	1.25	1.58	1.62
6	.....	2.85	1.90	1.48	1.15	1.58	1.75
7	2.30	2.95	1.90	1.40	1.10	1.78	1.62
8	2.50	3.05	1.85	1.35	1.10	1.62	1.52
9	2.70	3.12	1.75	1.30	1.00	1.75	1.42
10	2.65	2.75	1.68	1.20	1.00	1.68	1.26
11	2.28	2.75	1.42	1.32	1.00	1.42	1.34
12	2.18	2.58	1.50	1.38	1.00	1.45	.....
13	2.35	2.58	1.55	1.32	1.00	1.40	.....
14	2.52	2.60	1.72	1.28	1.00	1.40	.....
15	2.72	2.58	1.58	1.20	1.10	1.40	.....
16	2.75	2.75	1.58	1.30	1.10	1.35	.....
17	2.80	3.20	1.70	1.40	1.10	1.45	.....
18	2.75	2.65	1.78	1.35	1.10	1.45	.....
19	2.75	2.42	1.72	1.30	1.00	1.58	.....
20	2.50	2.52	1.62	1.20	1.00	1.45	.....

Daily gage height, in feet, of Laramie River at Woods Landing, Wyo., for 1911—Contd.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
21	2.40	2.92	1.50	1.30	1.00	1.30	.....
22	2.30	2.68	1.42	1.38	1.00	1.65	.....
23	2.32	2.48	1.32	1.70	1.00	1.85	.....
24	2.52	2.15	1.38	1.52	1.68	1.45	.....
25	2.65	2.35	1.32	1.32	1.55	1.40	.....
26	2.78	2.00	1.32	1.35	1.25	1.42	.....
27	2.60	1.90	1.65	1.35	1.10	1.42	.....
28	2.58	1.85	1.65	1.30	1.30	1.45	.....
29	2.68	1.80	1.65	1.22	1.24	1.48	.....
30	2.65	1.75	1.65	1.12	1.32	1.42	.....
31	2.75	.....	1.55	1.10	.....	1.40	.....

Daily discharge, in second-feet, of Laramie River at Woods Landing, Wyo., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1,080	200	165	30	170	36
2	.....	1,090	236	140	28	220	26
3	.....	1,080	410	110	32	170	25
4	.....	1,060	410	100	40	115	24
5	.....	1,180	375	100	45	80	70
6	.....	1,170	410	135	35	80	110
7	410	1,260	410	100	23	200	70
8	550	1,340	375	70	23	70	53
9	710	1,410	310	60	18	110	42
10	670	1,090	269	45	18	85	29
11	335	1,090	139	65	18	42	35
12	385	943	175	80	18	45	.....
13	495	943	200	65	18	40	.....
14	620	960	292	55	18	40	.....
15	780	943	215	45	23	40	.....
16	810	1,090	215	60	23	36	.....
17	905	1,480	280	80	23	45	.....
18	865	1,000	328	70	23	45	.....
19	865	811	292	60	18	62	.....
20	660	892	236	45	18	45	.....
21	580	1,230	175	60	18	32	.....
22	555	1,030	139	80	18	78	.....
23	570	859	98	180	17	152	.....
24	730	595	95	100	110	45	.....
25	835	755	75	55	70	40	M.....
26	945	480	75	60	34	42	.....
27	890	410	215	60	29	42	.....
28	835	375	215	50	37	45	.....
29	920	340	215	40	33	48	.....
30	890	316	215	35	31	42	.....
31	975	.....	195	32	.....	40	.....

NOTE.—Daily discharge determined as follows: May 7 to June 5 and July 16 to Oct. 7, by indirect method for shifting channels; June 6 to July 15 and Oct. 8 to Nov. 11, from fairly well-defined rating curves.

Monthly discharge of Laramie River at Woods Landing, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May 7-31	975	335	711	36,400	C.
June	1,480	310	943	56,100	C.
July	410	75	242	14,900	C.
August	180	32	77.5	4,770	C.
September	110	17	29.6	1,760	C.
October	220	32	75.7	4,650	C.
November 1-11	119	24	47.3	1,030	C.
The period	.....	.....	.....	120,000	

LARAMIE RIVER AT TWO RIVERS, WYO.

Location.—At highway bridge at Two Rivers post office, in sec. 5, T. 17 N., R. 74 W. The nearest tributary is Little Laramie River which enters one-fourth mile below the station.

Records available.—May 6 to November 4, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Slightly shifting.

Discharge measurements.—Made from the bridge.

Winter flow.—Ice causes backwater during the winter months and the records are discontinued.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions from Laramie River of 460 second-feet between Woods Landing and Two Rivers.

Accuracy.—Results are only fair.

Cooperation.—Station maintained in cooperation with the State engineer.

Discharge measurements of Laramie River at Two Rivers, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 6	Fletcher and Kingdon	2.10	95.0	June 25	R. H. Fletcher	3.50	439
June 5	R. H. Fletcher	3.60	488	Oct. 11	G. H. Russell	1.85	31.6
14	do	3.40	451				

Daily gage height, in feet of Laramie River at Two Rivers, Wyo., for 1911.

[A. R. Peters, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		3.3	2.4	1.65	1.6	1.55	2.2
2		3.65	2.4	1.6	1.6	1.6	2.25
3		3.65	2.4	1.6	1.6	1.6	2.3
4		3.5	2.4	1.55	1.6	1.6	2.4
5		3.5	2.4	1.5	1.6	1.6	
6	2.1	3.6	2.3	1.5	1.6	1.6	
7		3.55	2.35	1.45	1.6	1.65	
8		3.65	2.4	1.4	1.6	1.7	
9		3.75	2.35	1.4	1.6	1.7	
10		4.0	2.3	1.3	1.6	1.75	
11		3.85	2.15	1.25	1.6	1.8	
12	2.25	3.6	2.1	1.3	1.6	1.8	
13	2.65	3.45	1.9	1.4	1.5	1.8	
14	3.05	3.3	1.8	1.4	1.5	1.8	
15	3.05	3.4	1.8	1.4	1.5	1.85	
16	3.25	3.5	1.8	1.4	1.5	1.8	
17	3.6	3.95	1.55	1.4	1.5	1.85	
18	3.8	4.4	1.9	1.3	1.4	1.8	
19	3.75	4.3	1.9	1.3	1.35	1.8	
20	3.85	3.7	1.75	1.5	1.3	1.8	
21	3.75	3.5	1.6	1.5	1.3	1.8	
22	3.5	3.75	1.6	1.55	1.2	1.8	
23	3.4	4.1	1.6	1.6	1.2	2.0	
24	3.2	3.75	1.5	1.6	1.2	2.05	
25	3.15	3.5	1.4	1.6	1.2	2.1	
26	3.0	3.25	1.7	1.6	1.25	2.1	
27	3.15	3.0	1.7	1.6	1.3	2.2	
28	3.2	2.85	1.7	1.6	1.4	2.1	
29	3.0	2.5	1.7	1.55	1.5	2.0	
30	3.1	2.4	1.7	1.55	1.5	2.0	
31	3.2		1.7	1.6		2.0	

NOTE.—Ice present Oct. 23 to Nov. 24.

Daily discharge, in second-feet, of Laramie River at Two Rivers, Wyo., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	90	410	141	16	13	10	16	395	470	27	4	8	27
2	90	515	141	13	13	13	17	500	605	10	4	8	33
3	90	515	141	13	13	13	18	560	740	39	2	4	27
4	90	470	141	10	13	13	19	545	710	39	2	3	27
5	90	470	141	8	13	13	20	575	498	23	8	2	27
6	95	500	117	8	13	13	21	545	440	13	8	2	27
7	101	485	129	6	13	16	22	470	512	13	10	0	27
8	107	515	141	4	13	19	23	440	615	13	13	0	25
9	113	545	129	4	13	19	24	380	512	8	13	0	25
10	119	620	117	2	13	23	25	365	440	4	13	0	25
11	125	575	85	1	13	27	26	320	370	19	13	1	25
12	132	500	75	2	13	27	27	365	300	19	13	2	25
13	232	455	39	4	8	27	28	380	258	19	13	4	25
14	335	410	27	4	8	27	29	320	165	19	10	8	25
15	335	440	27	4	8	33	30	350	141	19	10	8	25
							31	380	.....	19	13	.....	25

NOTE.—Daily discharge determined as follows: May 6 to June 19 and June 20 to Oct. 22 from rating curves not well defined; discharge estimated May 1 to 5, May 7 to 11, and Oct. 23 to 31.

Monthly discharge of Laramie River at Two Rivers, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May	575	90	291	17,900	C.
June	740	141	473	28,100	C.
July	141	4	61.1	3,760	C.
August	16	1	8.0	492	C.
September	13	0	7.7	458	C.
October	33	10	23.0	1,410	C.
The period				52,100	

LITTLE LARAMIE RIVER NEAR FILMORE, WYO.

Location.—At May's ranch, in sec. 9, T. 15 N., R. 77 W., 1½ miles south of Filmore post office; 4 miles below the junction of the North, Middle, and South Forks; 8 miles above the mouth of Mill Creek, the nearest tributary below.

Records available.—May 14 to October 31, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Slightly shifting.

Discharge measurements.—Made from bridge during high water and by wading at ordinary stages.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions of 450 second-feet from the Little Laramie, both above and below the station.

Accuracy.—The shifting channel makes the estimates of discharge only fair.

Cooperation.—Station maintained in cooperation with State engineer.

Discharge measurements of Little Laramie River near Filmore, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 6	R. H. Fletcher	3.10	620
15	do	2.80	424
25	do	2.30	285
Oct. 10	G. H. Russell	1.00	31.8

Daily gage height, in feet, and discharge, in second-feet, of Little Laramie River near Filmore, Wyo., for 1911.

[Ralph May, observer.]

Day.	May.		June.		July.		August.		September.		October.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1	.....	.....	3.25	638	2.05	212	1.3	68	.08	12	1.2	55
2	.....	.....	3.3	660	2.05	212	1.25	62	.85	17	1.15	49
3	.....	.....	3.25	638	2.1	225	1.25	62	.85	17	1.1	43
4	.....	.....	3.4	705	2.05	205	1.2	55	.95	27	1.15	49
5	.....	.....	3.35	682	2.0	200	1.2	55	.9	22	1.35	75
6	.....	.....	3.45	728	2.0	200	1.15	49	.9	22	1.35	75
7	.....	.....	3.35	682	1.95	188	1.1	43	.9	22	1.2	55
8	.....	.....	3.9	930	1.95	188	1.05	38	.9	22	1.1	43
9	.....	.....	3.85	908	1.85	166	1.0	32	.9	22.	1.1	43
10	.....	.....	3.7	840	1.75	144	1.05	38	.9	22	1.1	43
11	.....	.....	3.5	750	1.6	114	1.15	49	.85	17	1.0	32
12	.....	.....	3.45	728	1.6	114	1.15	49	.85	17	1.0	32
13	.....	.....	3.2	615	1.6	114	1.15	49	.8	12	1.0	32
14	1.9	177	2.0	200	1.6	114	1.15	49	.8	12	1.0	32
15	2.15	240	2.05	212	1.6	114	1.05	38	.8	12	1.0	32
16	2.15	240	[a] 3.5	750	1.6	114	1.05	38	.8	12	1.0	32
17	2.2	255	3.4	705	1.55	106	1.05	38	.8	12	1.1	43
18	2.3	285	3.0	535	1.5	97	1.0	32	.8	12	1.1	43
19	2.2	255	2.75	438	1.65	124	1.0	32	.8	12	1.0	32
20	2.1	225	2.75	438	1.6	114	1.0	32	.85	17	1.0	32
21	2.0	200	2.7	420	1.55	106	1.0	32	.9	22	1.0	32
22	2.0	200	2.65	402	1.5	97	1.0	32	.9	22	1.0	32
23	2.0	200	2.55	368	1.5	97	1.0	32	.9	22	1.0	32
24	2.15	240	2.55	368	1.4	82	1.0	32	.9	22	1.0	32
25	2.2	255	2.45	333	1.4	82	1.0	32	.9	22	1.0	32
26	2.5	350	2.4	315	1.4	82	1.0	32	.9	22	1.0	32
27	2.45	332	2.25	270	1.35	75	1.0	32	.9	22	1.0	32
28	2.5	350	2.05	212	1.35	75	.95	27	.9	22	.9	22
29	2.6	385	2.05	212	1.35	75	.95	27	.9	22	.9	22
30	2.7	420	2.05	212	1.3	68	.9	22	.95	27	.85	17
31	3.05	555	.....	.....	1.3	68	.8	12	.....	.....	.85	17

[a] The maximum gage height on June 16 was 4.2 feet.

NOTE.—Daily discharge determined from a fairly well defined rating curve.

Monthly discharge of Little Laramie River near Filmore, Wyo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May 14-31	555	177	287	10,200	C.
June	930	212	530	31,500	C.
July	225	68	128	7,870	C.
August	68	12	39.4	2,420	C.
September	27	12	18.8	1,120	C.
October	75	17	37.9	2,330	C.
The period	.....	.....	.....	55,400	

LITTLE LARAMIE RIVER AT TWO RIVERS, WYO.

Location.—At highway bridge on section line between secs. 5 and 6, T. 17 N., R. 74 W., half a mile south of Two Rivers post office; nearest tributary, Mill Creek, enters about 12 miles above; no tributary between the station and the mouth, one-half mile below.

Records available.—May 6 to November 4, 1911.

Drainage area.—421 square miles (measured from Hayden's Atlas).

Gage.—Vertical staff.

Channel.—Somewhat shifting.

Discharge measurements.—Made from bridge during high water, and by wading at ordinary stages.

Winter flow.—Ice causes backwater during the winter months and the records are discontinued.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions from Little Laramie River of 450 second-feet, and from the tributaries, 326 second-feet. These diversions are all above the station.

Accuracy.—As the station has not been completely rated no estimates of discharge have been made.

Cooperation.—Station maintained in cooperation with State engineer.

Discharge measurements of Little Laramie River at Two Rivers, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 6	Fletcher and Kingdon	1.90	5.5
June 5	R. H. Fletcher	3.05	188
14	do	2.80	101
25	do	2.80	128
Oct. 11	G. H. Russell	1.25	[a] 0

[a] Water standing in pools.

Daily gage height, in feet, of Little Laramie River at Two Rivers, Wyo., for 1911.

[A. R. Peters, observer.]

Day.	May.	June.	July.	Oct.	Nov.	Day.	May.	June.	July.	Oct.	Nov.
1		2.25	2.2		2.15	16	1.0	2.8	1.8	1.4	
2		2.55	2.3		2.2	17	1.7	3.7	1.75	1.55	
3		2.7	2.3		2.2	18	1.7	4.15	1.7	1.65	
4		2.7	2.3		2.2	19	1.7	3.25	1.8	1.8	
5		3.0	2.2			20	1.9	2.75	1.75	1.85	
6	1.9	3.15	2.1			21	1.65	2.7	1.6	1.8	
7		3.2	2.1			22		3.35	1.6	1.8	
8		3.15	2.0			23		3.5	1.7	1.85	
9		3.6	2.0			24		3.0	1.7	1.9	
10		3.7	2.0			25		2.75	1.6	1.95	
11		3.4	2.0			26		2.7	1.6	2.05	
12	1.9	3.05	1.9			27		2.55		2.1	
13	1.05	2.9	1.8			28		2.5		2.1	
14	1.5	2.8	1.8			29		2.3		2.0	
15	1.45	2.7	1.8			30	1.9	2.2		2.05	
						31	1.9			2.1	

NOTE.—On days for which gage heights are omitted from May 1 to Nov. 4 the water stood in pools.

NORTH LARAMIE RIVER AT UVA, WYO.

Location.—At highway bridge in sec. 20, T. 25 N., R. 67 W., one-fourth mile west of Uva; 800 feet above the mouth.

Records available.—May 21 to November 10, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—It is probable that the station is within the influence of backwater from Laramie River during high water. This is the only section on the lower river where an observer can be obtained.

Discharge measurements.—Made from bridge during high water and by wading at ordinary stages.

Winter flow.—Ice causes backwater during the winter months and the records are discontinued.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions from North Laramie of 59 second-feet, and from the tributaries, 70 second-feet. These diversions are all above the station.

Accuracy.—The station has not been completely rated, and no estimates of flow have been made.

Cooperation.—Station maintained in cooperation with the State engineer.

Discharge measurements of North Laramie River at Uva, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 22	R. H. Fletcher	0.55	6.2
June 22	E. O. Christiansen	.69	6.0
July 2	R. H. Fletcher	.52	1.4
21	do	.44	.8
Oct. 19	G. H. Russell	.62	[a] 2.0

[a] Discharge estimated.

Daily gage height, in feet, of North Laramie River at Uva, Wyo., for 1911.

[W. H. Ralston, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	0.50	0.50	0.40	0.48	0.50	0.65	16	.....	[a]3.40	0.55	0.50	0.45	0.45	.....
2	.....	.50	.50	.40	.50	.50	.65	17	.....	1.10	.58	.50	.45	.45	.....
3	.....	.48	.50	.40	.50	.50	.65	18	.....	1.15	.55	.45	.45	.45	.....
4	.....	.45	.50	.40	.50	.50	.70	19	.....	.95	.55	.40	.50	[c].65	.....
5	.....	.45	.50	.40	.50	.48	.70	20	.....	.82	.55	.40	.48	.65	.....
6	.....	.38	.52	.40	.50	.45	.70	21	0.60	.72	.48	.40	.40	.65	.....
7	.....	.28	.55	.40	.45	.45	.70	22	.58	.70	.48	.40	.40	.65	.....
8	.....	.25	.55	.40	.45	.45	.70	23	.52	.68	.48	.40	.40	.65	.....
9	.....	.20	.55	.40	.45	.45	.70	24	.50	.68	.50	.40	.40	.65	.....
10	.....	.20	.52	.40	.45	.45	.70	25	.50	.60	.45	.40	.40	.65	.....
11	.....	.20	.48	.40	.45	.45	.....	26	.50	.60	.40	.40	.40	.65	.....
12	.....	.20	.45	.48	.45	45	.....	27	.50	.60	.40	.40	.45	.65	.....
13	.....	.20	.45	.50	.45	.45	.....	28	.50	.58	.40	.45	.48	.65	.....
14	.....	.20	([b])	.48	.45	.45	.....	29	.50	.57	.40	.48	.45	.65	.....
15	.....	.20	.....	.50	.45	.45	.....	30	.50	.52	.40	.45	.48	.65	.....
								31	.50	.....	.40	.45	.....	.65	.....

[a] Maximum, 6.0 feet.
[b] Backwater from Laramie River; flow above this influence practically unchanged.
[c] Increase due to closing of canal above.

CHUGWATER CREEK AT CHUGWATER, WYO.

Location.—At highway bridge in sec. 31, T. 21 N., R. 66 W., one-half mile from Chugwater. No important tributaries within several miles of the station.

Records available.—May 22 to December 31, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Reasonably permanent control for the station is formed by a low diversion dam about 300 feet below the gage.

Discharge measurements.—Made from bridge during high water and by wading at ordinary stages.

Winter flow.—Ice causes backwater during the winter months.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions from Chugwater Creek of 178 second-feet and from the tributaries 72 second-feet.

Accuracy.—As the station has not been completely rated, no estimates of discharge have been made.

Cooperation.—Station maintained in cooperation with the State engineer and with the Swan Land & Cattle Co.

Discharge measurements of Chugwater Creek at Chugwater, Wyo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 23	Fletcher and Johnston	0.62	3.8
Do.	do	.63	3.4
July 3	R. H. Fletcher	.55	[a] 1.5
22	Fletcher and Johnston	.80	9.7
Oct. 12	G. H. Russell	.62	2.9

[a] Estimated.

Daily gage height, in feet, of Chugwater Creek at Chugwater, Wyo., for 1911.

[A. A. Woolwer, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		0.60	0.54	0.60	0.62	0.68	0.72	0.68
2		.59	.55	.60	.62	.68	.75	.68
3		.58	.55	.60	.62	.68	.75	.69
4		.58		.60	.62	.62	.75	.70
5		.58	.54	.60	.62	.66	.74	.70
6		.58	.54	.60	.62	.66	.78	.70
7		.57	.54	.60	.64	.65	.79	.70
8		.57	.54	.60	.64	.60	.90	.70
9		.57	.54	.60	.65	.60	.85	.70
10		.57	.54	.60	.61	.60	.78	.70
11		.57	.55	.60	.60	.60	.75	.70
12		.58	.55	.60	.60	.62	.72	.70
13		.58	.56	.60	.60	.62	.70	.69
14		.58	[a] 2.00	.61	.60	.62	.66	.68
15		.57	.84	.60	.60	.69	.82	.67
16		1.15	.68	.60	.60	.70	.90	.66
17		.60	.66	.60	.60	(c)		.64
18		.58	.64	.60	.60			.66
19		.58	.62	1.50	.60			.65
20		.56	.61	.78	.60			.64
21		.58	.60	.71	.60		.85	.66
22	0.65	.58	[b] 1.45	.70	.60	.70	.86	.65
23	.64	.56	.69	.70	.60	.72	.75	.65
24	.64	.56	.62	.72	.60	.70	.70	.64
25	.63	.56	.60	.70	.60	.70	.74	.64
26	.62	.56	.60	.70	.60	.71	.78	.64
27	.66	.55	.60	.68	.60	.70	.70	.63
28	.62	.54	.60	.66	.60	.72	.70	.64
29	.60	.54	.60	.64	.60	.72	.69	.64
30	.60	.54	.60	.62	.60	.72	.65	.64
31	.60		.60	.62		.72		.65

[a] Maximum 2.4. [b] Maximum 2.8. [c] Temporary backwater.

HORSE CREEK NEAR LITTLE HORSE CREEK, WYO.

Location.—At upper Coad ranch, in sec. 10, T. 18 N., R. 62 W., 1 mile from Little Horsecreek post office; 1 mile above mouth of Little Horse Creek, the nearest tributary.

Records available.—December 1 to 31, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Data too meager to determine.

Discharge measurements.—Made by wading.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions from Horse Creek of 1,216 second-feet, nearly all below the station.

Accuracy.—No estimates of discharge have been made, as base data are insufficient.

Cooperation.—Station maintained in cooperation with State engineer and Mr. J. A. Whiting.

The following discharge measurement was made by Watson and Whiting: December 1, 1911: Gage height, 1.60 feet; discharge, 12 second-feet.

Daily gage height, in feet, of Horse Creek near Little Horse Creek, Wyo., for 1911.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1	1.60	6	1.75	11	1.60
2	.....	7	1.60	12	1.60
3	1.62	8	1.60	13	1.70
4	1.60	9	1.60	14	1.60
5	1.60	10	1.60	15	1.80
				16	1.80

HORSE CREEK NEAR LAGRANGE, WYO.

Location.—At Wye Cross ranch, about sec. 28, T. 20 N., R. 61 W., 3 miles above Lagrange, Wyo., 1 mile below mouth of Bear Creek.

Records available.—December 1 to 31, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Data too meager to determine.

Discharge measurements.—Made from bridge during high water and by wading at ordinary stages.

Winter flow.—Ice causes backwater during the winter months.

Diversions.—Prior to July 1, 1912, there were adjudicated diversions from Horse Creek of 1,216 second-feet and of 224 second-feet from tributaries entering above the station.

Accuracy.—Data insufficient for estimates of daily and monthly discharge.

Cooperation.—Station maintained in cooperation with State engineer.

The following discharge measurement was made by Watson and Whiting: December 1, 1911: Gage height, .40 feet; discharge, 2.2 second-feet.

Daily gage height, in feet, of Horse Creek near Lagrange, Wyo., for 1911.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1	.04	11	0.8	21	3.1
2	.4	12	.8	22	2.2
3	.5	13	.8	23	3.1
4	.6	14	.8	24	3.1
5	.5	15	.8	25	3.1
6	.6	16	.8	26	3.1
7	.6	17	.8	27	3.1
8	.8	18	.8	28	3.3
9	.8	19	1.2	29	3.7
10	.8	20	1.1	30	3.7
				31	3.7

NOTE.—Ice present during the greater part of December.

MIDDLE FORK[1] OF SOUTH PLATTE RIVER AT FAIRPLAY, COLO.

Location.—At the highway bridge at Fairplay, in sec. 33, T. 9 S., R. 77 W., 1 mile above the mouth of Beaver Creek and about 3 miles below the mouth of Sacramento Creek.

Records available.—October 17, 1910, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Somewhat shifting.

Discharge measurements.—Made by wading.

Winter flow.—Ice causes backwater during the winter months.

Diversions.—There are no court decrees for diversions from Middle Fork above the station, but decrees for diversions of 1,092 second-feet below. There are also decrees for diversions of 147 second-feet from tributaries entering above.

Accuracy.—As the station has not been completely rated no estimates of discharge have been made.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of Middle Fork of South Platte River at Fairplay, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 1	O. M. Wimmer	.75	8.8
Apr. 24	do	1.03	20.5
Sept. 16	do	1.30	28.2

Daily gage height, in feet, of Middle Fork of South Platte River at Fairplay, Colo., for 1911.

[E. N. Brown, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.50	0.70	0.75	0.79	1.00	1.85	1.75	1.5	1.25	1.2	1.3	1.1
2	.50	[a] 1.60	.75	.82	1.02	1.9	2.2	1.45	1.3	1.25	1.15	1.15
3	.50	.70	.62	1.00	1.05	1.9	2.3	.....	1.35	1.2	1.35	1.1
4	.40	[a] 1.60	.67	.92	1.25	1.95	.....	.....	1.3	.....	1.2	1.1
5	.40	.....	.....	.83	.....	2.05	2.6	1.5	.....	.....	1.2	1.2
6	.40	1.80	.68	.79	1.4	2.05	2.65	1.45	1.25	.....	.....	1.1
7	.40	1.70	.70	.72	1.4	2.1	2.6	1.45	1.2	1.15	.....	.....
8	.40	1.90	.64	.73	1.5	2.2	2.25	1.4	1.2	1.2	1.1	1.0
9	.50	1.90	.68	.83	1.5	.....	2.2	1.5	1.2	1.15	1.2	1.05
10	.60	[a] 1.90	.....	.75	1.45	2.0	2.3	1.5	1.25	.....	.....	1.0
11	.70	.....	.72	.73	1.4	2.25	.....	1.4	.....	.....	.....	1.0
12	.70	.....	.....	.....	1.35	2.4	.....	1.4	.....	1.25	1.2	1.05
13	.70	.....	.70	.71	1.4	2.15	.....	1.5	1.2	1.25	1.25	1.0
14	.70	.70	.75	.70	1.4	2.1	.....	1.4	.....	1.3	.....	.....
15	.....	.70	.78	.72	1.5	2.2	.....	.....	1.25	1.25	.....	.....
16	.70	.70	.75	.73	1.5	2.1	.....	.....	1.25	1.2	1.1	1.0
17	.....	.70	.75	.73	1.6	2.2	1.8	.....	1.2	1.3	.....	.....
18	.60	.....	.70	1.00	.....	2.0	1.7	1.55	.....	1.35	1.25	1.0
19	.....	.....	.....	1.02	1.5	2.2	1.75	1.55	1.25	1.2	.....	1.05
20	.70	.70	.73	1.02	1.45	2.2	.....	1.5	1.15	1.3	1.3	1.05
21	.70	.60	.70	1.03	1.4	2.3	1.7	1.5	1.3	1.25	1.2	1.0
22	.....	.60	.75	1.30	1.35	2.3	1.65	1.6	.....	1.3	.....	.....
23	[a] 1.60	.50	.76	.....	1.35	2.4	1.6	.....	1.25	1.25	1.15	1.0
24	.70	.50	.75	1.03	.....	2.3	.....	.....	.....	1.3	.....	.....
25	.70	.60	.80	1.08	.....	2.1	.....	1.3	1.15	1.4	.....	.....
26	.....	.....	.....	1.08	.....	1.8	.....	1.3	1.2	1.3	.....	.....
27	.70	.70	.78	1.25	1.5	1.75	1.5	1.25	1.2	1.2	.....	.....
28	.70	.70	.65	1.13	1.55	1.8	1.5	.....	.....	1.4	1.2	.....
29	.....	.....	.71	1.30	1.6	1.75	1.5	.....	.....	1.15	1.15	.....
30	.70	.....	.70	1.05	1.75	1.6	1.55	.....	1.35	1.3	1.25	.95
31	.....	.....	.72	.....	1.85	.....	.....	.....	.....	1.35	.....	.95

[a] Ice gorge.

NOTE.—Ice caused backwater Nov. 20 to Dec. 31, and it is probable that gage heights were affected by ice during January, February, and March; approximate thickness of ice during December, 0.3 foot.

[1] Erroneously called the South Fork in 1910 report.

SOUTH FORK OF SOUTH PLATTE RIVER AT LAKE GEORGE, COLO.

Location.—At highway bridge in sec. 19, T. 12 S., R. 71 W., one-fourth mile below Lake George, in the Pike National Forest, about 2 miles above the mouth of Caylor Gulch; no tributary between the outlet of the lake and the station.

Records available.—October 22, 1910, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Automatic recording gage installed in 1911, reading to the same datum as the original staff gage.

Channel.—Conditions in the channel will remain unchanged as long as the control for the station—a 2-foot timber-crib dam 50 feet below the gage—remains permanent.

Discharge measurements.—Made from bridge during high water and by wading at ordinary stages.

Winter flow.—Ice causes backwater during the winter months and measurements are made to determine the flow.

Artificial control.—The discharge at the station is controlled naturally to some extent by the regulating effect of Lake George, which has an area of one-half square mile.

Diversions.—There are court decrees for diversions of 1,076 second-feet from the South Fork above this station and for diversions of 1,816 second-feet from tributaries entering above.

Accuracy.—As the station has not been completely rated, no estimates of discharge have been made.

Cooperation.—Station maintained in cooperation with United States Forest Service and the State engineer of Colorado.

Discharge measurements of South Fork of South Platte River at Lake George, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 11[a]	Russell and Wimmer	0.74	1.6
Apr. 26	O. M. Wimmer	1.20	12.9
July 8	E. O. Christiansen	3.32	729
Sept. 25	H. B. Waha	1.78	41.9

[a] Ice conditions.

Daily gage height, in feet, of South Fork of South Platte River at Lake George, Colo., for 1911.

[F. C. Parrett, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.70	.....	0.85	2.0	0.95	1.05	2.2	2.3	2.0	1.7	1.55	1.3
2	.....	.....	1.0	2.0	1.05	1.05	2.45	2.3	2.0	1.7	1.55	1.25
3	.....	.....	1.0	1.9	1.05	1.05	3.5	2.2	2.0	1.5	1.6	1.05
4	.....	.....	.9	2.0	1.05	1.0	3.4	2.2	1.95	1.3	1.65	1.05
5	.....	.....	1.1	1.85	1.15	.95	3.5	2.15	1.9	1.45	1.65	1.15
6	.6	.....	1.0	1.7	1.15	1.0	3.3	2.1	1.90	1.8	1.65	1.15
7	.....	.....	1.1	1.55	1.05	1.5	3.25	2.05	1.85	2.0	1.6	1.15
8	.7	.....	1.2	1.35	1.2	1.75	3.35	2.0	1.85	1.95	1.6	1.1
9	.68	.....	1.35	1.35	1.2	1.95	3.1	2.0	1.85	1.65	1.6	1.15
10	.72	.....	1.7	1.25	1.1	1.9	2.8	2.0	1.8	1.6	1.6	1.05
11	.74	.....	1.75	1.4	1.05	1.85	2.1	2.05	1.8	1.7	1.35	.95
12	.....	.....	1.25	1.4	1.05	1.8	2.2	2.15	1.8	1.45	1.45	.95
13	.....	.....	1.35	1.15	1.05	1.85	2.1	2.1	1.75	1.15	1.45	1.0
14	.....	.....	1.55	1.05	1.0	2.15	2.35	2.05	1.75	1.6	1.4	.....
15	.....	.....	1.6	1.1	1.15	2.3	2.3	2.05	1.85	1.6	1.5	1.0

Daily gage height, in feet, of South Fork of South Platte River at Lake George, Colo., for 1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	.....	.....	1.65	1.05	1.3	2.4	2.4	2.0	1.9	1.55	1.5	.90
17	.....	1.05	1.6	1.2	1.4	2.45	2.15	2.05	1.9	1.55	1.4	.....
18	.8	1.0	1.65	1.2	1.45	2.45	2.05	2.1	1.8	1.5	1.4	.90
19	.....	1.05	1.5	1.2	1.45	2.7	2.15	2.05	1.7	1.5	1.3	.....
20	.....	.95	1.6	1.1	1.35	2.75	2.2	2.0	1.7	1.45	1.3	1.00
21	.....	.8	1.7	1.2	1.45	2.75	2.45	2.05	1.75	1.4	1.4	.....
22	.....	.8	1.6	1.2	1.50	2.75	2.5	2.1	1.8	1.4	1.5	.....
23	.....	.8	1.65	1.1	1.5	2.85	2.55	2.25	1.8	1.6	1.6	.....
24	.....	1.0	1.8	1.2	1.4	2.7	2.6	2.35	2.0	1.9	1.55	.....
25	.....	1.0	1.95	1.25	1.4	2.4	2.65	2.3	2.15	1.9	1.55	.....
26	.....	.85	1.6	1.3	1.4	2.3	2.7	2.05	1.7	1.65	1.6	.....
27	.....	.75	1.6	1.25	1.35	2.2	2.6	2.05	1.7	1.65	1.45	.....
28	.....	.8	1.65	1.2	1.2	2.25	2.45	2.05	1.7	1.65	1.35	.....
29	.....	.....	1.95	1.15	1.2	2.25	2.3	2.05	1.7	1.4	1.4	.....
30	.....	.....	1.7	1.05	1.05	2.2	2.35	2.0	1.7	1.25	1.3	.....
31	.....	.....	1.45	.....	1.1	.....	2.3	2.0	.....	1.5	.....	.....

NOTE.—Ice present Jan. 1 to Feb. 16 and Dec. 3 to 31.

SOUTH FORK OF SOUTH PLATTE RIVER AT SOUTH PLATTE, COLO.

Location.—In sec. 25, T. 7 S., R. 70 W., in the Pike National Forest, half a mile east of South Platte, 600 feet above junction with the North Fork.

Records available.—May 8, 1905, to December 31, 1911.

Drainage area.—2,160 square miles.

Gage.—Inclined staff; datum unchanged.

Channel.—Somewhat shifting.

Discharge measurements.—Made from car and cable during highwater and by wading at ordinary stages.

Winter flow.—Ice causes backwater during the winter months and measurements are made to determine the flow.

Artificial control.—The flow is controlled to a certain extent by the Cheeseman reservoir, 20 miles upstream, which has a capacity of 79,000 acre-feet. No very important tributaries enter between the reservoir and this station.

Diversions.—There are no court decrees for diversions from the South Fork between this station and the one at Lake George; but decrees for diversion of 1,400 second-feet from intervening tributaries.

Accuracy.—Although the channel is somewhat shifting, sufficient discharge measurements have been made to enable reliable estimates of discharge to be made.

Cooperation.—Station maintained in cooperation with the State engineer.

Discharge measurements of South Fork of South Platte River at South Platte, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 10[a]	R. H. Fletcher	1.98	75.6	July 11	G. H. Russell	3.95	944
Feb. 22[a]	do	1.90	77.3	Aug. 18	R. H. Fletcher	2.35	200
Mar. 16	do	1.50	46.7	29	do	2.55	237
May 10	Miles and Turner	1.87	71.9	Sept. 8	Waha and Fletcher	2.40	196
23	R. C. Miles	2.80	344	Nov. 4	G. H. Russell	1.92	71.6
June 12	J. B. Stewart	2.00	93.9	Dec. 16[b]	R. H. Fletcher	1.80	73.4

[a] Ice conditions. [b] Slight ice effect.

Daily gage height, in feet, of South Fork of South Platte River at South Platte, Colo., for 1910-11.

[Miss A. Vermillion, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	2.25	2.2	2.0	2.6	3.1	2.7	2.45	2.25	2.05	2.0	1.9	1.7
2	2.3	2.15	2.1	2.6	3.1	2.7	2.7	3.15	2.05	2.0	1.85	1.7
3	2.2	2.1	2.2	2.65	3.1	2.7	2.9	3.4	2.0	2.0	1.8	1.7
4	2.2	2.0	2.2	2.6	3.2	2.7	2.8	3.3	2.0	1.95	1.85	1.7
5	2.2	2.0	2.5	2.6	3.25	2.7	2.8	3.1	2.0	1.9	1.95	1.6
6	2.4	2.0	2.7	2.6	3.05	2.7	2.8	3.05	1.9	1.9	2.0	1.65
7	2.5	1.9	2.7	2.0	3.0	2.95	2.8	3.0	1.85	1.9	2.0	1.7
8	2.5	1.7	2.7	2.0	2.9	2.85	2.8	2.9	1.85	1.9	2.0	1.7
9	2.6	1.7	2.75	2.0	2.8	2.8	2.35	2.85	1.95	1.95	2.05	1.75
10	2.6	1.7	3.6	2.6	2.8	2.75	1.9	3.3	1.85	1.95	2.1	1.7
11	2.3	1.75	3.55	2.65	2.8	2.8	1.9	3.3	1.9	1.95	2.1	1.7
12	2.3	1.65	3.4	2.65	2.9	2.7	1.9	3.3	1.9	1.95	2.05	1.7
13	2.3	1.7	3.3	2.7	2.9	2.75	1.9	3.4	1.9	1.9	2.0	1.65
14	2.25	1.75	3.2	2.85	2.8	2.65	1.9	3.25	1.9	1.95	2.05	1.65
15	2.3	1.9	3.2	2.8	3.0	2.75	1.9	2.35	1.9	1.95	2.05	1.65
16	2.3	1.9	3.1	2.6	2.95	2.8	1.9	2.0	1.9	1.95	2.05	1.65
17	2.4	1.95	3.15	2.65	3.05	2.8	2.0	2.55	2.0	2.0	2.0	1.65
18	2.4	1.95	3.2	2.65	3.25	2.9	2.05	2.55	1.95	2.0	2.0	1.8
19	2.5	2.0	3.2	2.65	3.15	2.9	2.0	2.55	1.9	2.0	1.95	1.8
20	2.45	2.1	3.2	2.7	2.95	2.7	2.1	2.3	1.9	2.0	1.9	1.7
21	2.5	2.25	3.2	2.8	2.95	2.5	2.1	2.5	2.05	2.0	1.9	1.8
22	2.5	2.2	3.2	2.85	3.0	2.6	2.15	2.55	2.1	2.15	1.8	1.9
23	2.45	2.2	2.9	2.85	3.1	2.6	2.1	2.55	2.25	2.15	1.85	1.85
24	2.3	2.1	2.9	2.85	3.2	2.6	2.1	2.55	2.15	2.15	1.8	1.85
25	2.25	2.0	2.9	2.9	3.2	2.2	2.75	2.0	2.15	2.15	1.75	1.9
26	2.15	2.0	2.8	2.9	3.1	2.2	2.75	2.05	2.15	2.15	1.85	1.9
27	2.2	2.0	2.8	2.9	2.9	2.1	2.75	2.1	2.15	2.1	1.85	1.9
28	2.2	2.0	2.7	2.9	3.0	2.15	2.8	2.05	2.15	2.1	1.7	2.1
29	2.15	.....	2.7	3.0	2.85	2.2	3.6	2.05	2.15	2.1	1.8	2.0
30	2.2	.....	2.6	3.0	2.7	2.2	2.8	2.0	2.15	2.1	1.8	2.0
31	2.2	.....	2.6	.....	2.7	.....	2.75	2.1	.....	2.1	.....	2.05
1911.												
1	2.0	1.7	1.85	1.5	2.2	2.05	3.0	2.5	2.6	2.1	1.8	2.0
2	1.85	1.6	1.65	2.0	2.1	2.05	3.0	2.25	2.7	2.1	1.9	2.0
3	1.9	1.6	1.75	2.5	2.05	2.25	3.1	2.25	2.7	2.1	1.9	2.0
4	1.9	1.7	1.8	2.7	2.0	2.25	3.0	2.25	2.6	2.4	1.9	2.1
5	2.0	1.8	1.75	2.75	1.95	2.1	3.0	3.0	2.6	2.4	1.9	2.0
6	1.9	1.65	1.75	2.75	1.9	2.0	2.75	3.1	2.5	2.4	1.85	2.0
7	1.9	1.8	1.7	2.65	1.9	1.95	3.25	3.05	2.5	2.1	1.85	2.0
8	2.0	1.7	1.75	2.5	1.9	1.95	4.1	2.3	2.4	2.0	1.85	2.0
9	1.8	1.75	1.7	2.3	1.9	1.95	4.1	2.3	2.4	2.0	1.9	1.7
10	2.1	1.7	1.75	2.15	1.85	1.95	4.1	3.0	2.4	1.8	1.9	1.6
11	2.05	1.7	1.7	2.1	1.85	1.95	4.05	2.6	2.3	1.8	1.9	1.5
12	2.0	1.75	1.65	2.1	1.9	1.95	4.0	2.4	2.3	1.75	2.0	2.0
13	1.9	1.75	1.5	2.05	1.8	1.95	4.0	2.4	2.25	1.7	1.8	2.1
14	1.8	1.75	1.45	2.05	1.85	1.95	4.0	2.4	2.2	1.7	1.8	1.8
15	1.9	1.75	1.5	2.0	1.85	2.1	4.0	2.35	2.1	1.7	1.8	1.8
16	2.0	1.8	1.55	2.0	1.9	2.3	4.0	2.3	2.1	1.7	1.8	1.8
17	1.85	1.8	1.5	2.0	1.85	2.3	4.0	2.3	2.15	1.7	1.8	1.8
18	1.65	1.8	1.45	1.95	1.9	2.3	2.4	2.4	2.1	1.7	1.8	1.85
19	1.7	1.65	1.5	1.95	1.9	2.3	2.25	2.4	2.1	1.7	1.8	1.95
20	1.75	1.55	1.5	1.9	2.1	2.3	3.3	2.4	2.1	1.7	1.8	1.85
21	2.0	1.65	1.55	1.8	2.7	2.7	3.3	2.3	2.1	1.7	1.8	1.75
22	1.8	2.1	1.6	1.95	2.75	2.7	3.3	2.3	2.1	1.7	1.8	1.8
23	1.8	2.05	1.5	2.0	2.75	2.5	3.6	3.2	2.1	1.7	1.75	2.1
24	2.05	2.1	1.55	1.85	2.75	2.5	3.6	3.2	2.1	1.7	1.75	2.0
25	2.0	2.1	1.5	1.9	2.75	2.7	3.6	3.2	2.1	1.7	2.0	1.9
26	1.95	2.0	1.5	1.85	2.75	2.7	3.5	3.2	2.1	1.7	2.0	1.8
27	1.9	1.85	1.4	1.7	2.75	2.8	3.2	2.6	2.1	1.7	1.8	1.7
28	1.9	1.9	1.55	1.75	2.45	2.8	3.0	2.6	2.1	1.7	1.6	3.7
29	1.85	.....	1.5	1.9	2.15	2.9	3.0	2.6	2.1	1.7	1.8	4.0
30	1.85	.....	1.5	2.4	2.1	3.0	2.8	2.6	2.1	1.7	2.0	2.7
31	1.7	.....	1.45	.....	2.1	.....	2.75	2.6	.....	1.8	.....	2.6

NOTE.—Ice present Jan. 1 to 10 and Dec. 18 to 31, 1910; gage heights for 1910, published in Water Supply Paper No. 286, were partly in error as necessary corrections were not applied; corrected gage heights given in above table. Ice present Jan. 1 to Feb. 26, and Nov. 26 to Dec. 31, 1911.

Daily discharge, in second-feet, of South Fork of South Platte River at South Platte, Colo., for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	110	122	94	242	425	317	200	170	125	114	95	54
2	110	113	114	242	430	318	274	455	125	114	88	54
3	110	104	136	258	434	319	342	580	114	114	80	54
4	115	88	136	242	476	320	308	530	114	114	86	54
5	115	88	214	242	503	318	308	435	114	96	110	46
6	120	88	274	242	420	315	308	410	96	96	109	50
7	120	75	242	94	405	408	308	382	88	96	108	54
8	125	53	274	94	370	362	308	340	88	96	106	54
9	130	53	291	94	335	335	173	315	105	105	117	59
10	135	53	644	242	337	317	78	564	88	105	127	54
11	142	58	620	258	339	330	78	564	96	105	125	54
12	142	49	550	258	380	295	78	564	96	105	115	54
13	142	53	506	274	380	305	78	610	96	105	103	50
14	132	58	462	325	340	270	78	541	96	105	112	50
15	142	78	462	308	425	300	78	173	96	105	110	50
16	142	78	420	242	403	315	78	114	96	105	110	50
17	162	86	441	258	445	312	94	246	114	114	100	50
18	162	86	462	258	540	343	104	246	105	114	98	45
19	184	94	462	258	490	340	94	246	96	114	90	45
20	173	114	462	274	408	274	114	182	96	114	82	45
21	184	148	462	308	410	214	114	240	125	114	80	45
22	184	136	462	325	430	242	125	256	136	147	70	45
23	173	136	342	325	476	242	114	256	170	147	70	45
24	142	114	342	325	520	242	114	256	147	147	64	45
25	132	94	342	342	522	136	292	136	147	147	59	45
26	113	94	308	342	480	136	308	125	147	147	70	55
27	122	94	308	342	395	114	322	136	147	136	70	55
28	122	94	274	338	435	125	362	125	147	136	54	55
29	113	.....	274	378	375	136	550	125	147	136	64	55
30	122	.....	242	380	314	136	350	114	147	136	64	55
31	122	.....	242	.....	316	.....	322	136	.....	136	.....	55
1911.												
1	65	55	72	46	142	105	432	242	254	106	58	85
2	65	50	53	94	116	105	432	165	290	106	70	85
3	65	50	61	233	105	156	480	165	290	106	70	85
4	65	55	66	302	94	156	432	165	254	188	70	85
5	70	65	61	323	86	116	432	448	254	188	70	85
6	70	55	61	323	78	94	323	500	220	188	64	85
7	70	65	56	284	78	86	555	472	220	106	64	85
8	70	55	61	233	78	86	1,040	170	188	86	64	85
9	75	60	56	170	78	86	1,040	170	188	86	70	75
10	75	55	61	129	72	86	1,040	442	188	58	70	75
11	75	55	56	116	72	86	1,010	283	158	58	70	75
12	75	60	53	116	78	86	975	215	158	53	86	75
13	70	60	46	105	66	86	975	215	144	48	58	75
14	70	60	44	105	72	86	975	215	130	48	58	75
15	70	60	46	94	72	116	975	200	106	48	58	75
16	75	65	48	94	78	170	975	182	106	48	58	75
17	70	65	46	94	72	170	975	182	118	48	58	75
18	55	65	44	86	78	170	200	200	106	48	58	75
19	55	55	46	86	78	170	130	198	106	48	58	80
20	60	60	46	78	116	170	585	198	106	48	58	80
21	65	70	48	66	302	302	585	175	106	48	58	80
22	65	77	50	86	323	302	585	175	106	48	58	80
23	65	77	46	94	323	233	750	540	106	48	53	80
24	65	85	48	72	323	233	750	540	106	48	53	90
25	75	90	46	78	323	302	755	540	106	48	53	90
26	85	94	46	72	323	302	700	540	106	48	58	90
27	75	72	42	56	323	344	545	260	106	48	58	90
28	75	78	48	61	216	344	445	260	106	48	42	100
29	70	.....	46	78	129	386	445	260	106	48	58	100
30	70	.....	46	200	116	432	355	254	106	48	86	100
31	55	.....	44	.....	116	.....	335	254	.....	58	.....	100

NOTE.—Daily discharge for 1910, published in Water Supply Paper No. 286, erroneous because of noncorrection of gage heights and method of computing; revised determination presented here. Discharge estimated Jan. 1 to 10 and Dec. 18 to 31, 1910, on account of presence of ice. Daily discharge determined Jan. 11 to 31, Feb. 15 to Apr. 27, May 10 to June 4, June 21 to July 24, Aug. 12 to Oct. 31, and Nov. 23 to Dec. 17, 1910, from fairly well-defined curves; indirect method for shifting channels used for the remaining periods of 1910. Daily discharge Jan. 1 to Feb. 26 and Nov. 26 to 31, 1911, estimated because of ice; daily discharge Feb. 27 to July 11 and Aug. 30 to Nov. 25, 1911, determined from two curves well-defined between 50 and 450 second-feet; indirect method for shifting channels used from July 12 to Aug. 29, 1911.

Monthly discharge of South Fork of South Platte River at South Platte, Colo., for 1910–11

[Drainage area, 2,160 square miles.]

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
January	184	110	137	8,410	B.
February	148	49	89.3	4,960	B.
March	644	94	350	21,500	B.
April	380	94	270	16,100	B.
May	540	314	418	25,700	B.
June	408	114	271	16,100	B.
July	550	78	208	12,800	B.
August	610	114	310	19,000	B.
September	170	88	117	6,950	B.
October	147	96	118	7,270	B.
November	127	54	91.2	5,430	B.
December	59	45	50	3,080	B.
The year	644	45	204	147,000	
1911.					
January	85	55	70.6	4,340	B.
February	94	50	64.8	3,600	B.
March	72	42	51.4	3,160	B.
April	323	46	132	7,880	A.
May	323	66	146	8,980	A.
June	432	86	186	11,000	A.
July	1,040	130	653	40,100	A.
August	540	165	285	17,500	A.
September	290	106	155	9,210	A.
October	188	48	72.6	4,460	A.
November	86	42	62.2	3,700	B.
December	100	75	83.6	5,140	B.
The year	1,040	42	165	119,000	

NOTE.—Monthly estimates for this station for 1910, as published in Water Supply Paper 286, are in error, and the revised values are published herewith.

SOUTH PLATTE RIVER AT SOUTH PLATTE, COLO.

Location.—In sec. 25, T. 7 S., R. 70 W., in the Pike National Forest, three-fourths of a mile east of South Platte; about 300 feet below junction of the North and South forks; no tributary between the forks and the station, and none for several miles below.

Records available.—March 28, 1902, to December 31, 1911. Records at Platte Canyon and at Deansbury, a few miles below, extend back to 1887 with the exception of the years 1893 and 1894. The earlier records, 1887–1892, were taken by the State engineer, and the records from 1895 to 1898 were taken under the direction of the Denver Power & Irrigation Co.

Drainage area.—2,610 square miles.

Gage.—An automatic recording gage, installed by the State engineer March 14, 1910. From March 28, 1902, to May 7, 1905, the gage was at the highway bridge. On the latter date it was moved to its present site, 150 feet below. It is probable that the new gage read to a somewhat different datum. The recording gage is referred to the datum of the gage established in 1905.

Channel.—Shifting.

Discharge measurements.—Made from car and cable during high water, and by wading at low stages.

Winter flow.—Ice causes backwater during a portion of the winter months and measurements are made to determine the flow.

Artificial control.—The flow is controlled to a certain extent by the Cheesman reservoir which is on the South Fork about 20 miles above the forks.

Diversions.—No water is diverted between this station and that on the South Fork at South Platte nor between this station and that on the North Fork at Cassells.

Accuracy.—Although the channel is shifting, sufficient discharge measurements have been obtained to enable fair estimates of discharge to be made.

Cooperation.—Station maintained in cooperation with the State engineer.

Discharge measurements of South Platte River at South Platte, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 10[a]	R. H. Fletcher	2.08	111	July 11	G. H. Russell	4.28	1,190
Feb. 22[a]	do	1.88	106	Aug. 18	R. H. Fletcher	2.37	308
Mar. 15	do	1.48	72.2	29	do	2.00	324
16	do	1.60	98.0	Sept. 8	Fletcher and Waha	2.04	284
May 10	Turner and Miles	2.58	361	Nov. 3	G. H. Russell	1.65	94.1
June 12	J. B. Stewart	2.75	445	Dec. 16[a]	R. H. Fletcher	1.80	116

[a] Ice conditions.

Daily gage height, in feet, of South Platte River at South Platte, Colo., for 1910–11.

[Miss A. Vermillion, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	2.6	2.0	1.9	2.6	3.3	3.4	2.8	2.65	2.0	1.9	1.9	1.5
2	2.4	2.1	2.0	2.65	3.3	3.4	2.8	3.25	2.05	1.9	1.85	1.5
3	2.5	2.0	2.2	2.65	3.3	3.4	2.9	3.4	2.0	1.9	1.85	1.6
4	2.3	1.9	2.2	2.5	3.4	3.4	2.85	3.3	2.05	1.9	1.85	1.6
5	2.3	1.9	2.5	2.5	3.4	3.25	2.85	3.15	2.0	1.85	1.95	1.4
6	2.5	1.9	2.6	2.45	3.25	3.25	2.8	3.2	1.9	1.9	1.9	1.4
7	2.6	1.7	2.55	2.5	3.2	3.35	2.75	3.1	1.85	1.9	1.9	1.45
8	2.7	1.7	2.65	2.5	3.15	3.3	2.65	2.9	1.85	1.95	2.0	1.6
9	2.7	1.7	2.7	2.5	3.15	3.25	2.55	2.75	1.95	1.9	2.0	1.6
10	2.5	1.65	3.55	2.5	3.2	3.2	2.1	3.35	1.95	1.9	2.0	1.65
11	2.5	1.7	3.55	2.55	3.2	3.15	2.05	3.35	1.85	1.95	2.05	1.6
12	2.6	1.7	3.4	2.6	3.25	3.2	2.0	3.45	1.85	1.9	2.05	1.6
13	2.6	1.75	3.3	2.7	3.35	3.1	2.0	3.4	1.9	1.8	2.0	1.7
14	2.45	1.8	3.3	2.85	3.45	3.2	2.0	3.25	1.9	1.85	1.95	1.55
15	2.5	1.9	3.3	2.8	3.45	3.1	2.05	2.35	1.9	1.95	2.0	1.65
16	2.3	2.0	3.3	2.65	3.4	3.15	2.05	2.25	1.9	2.05	2.0	1.65
17	2.4	1.9	3.25	2.7	3.35	3.2	2.05	2.4	1.9	2.1	1.9	1.7
18	2.5	1.95	3.3	2.7	3.55	3.15	2.05	2.5	1.9	2.05	1.95	1.8
19	2.5	2.0	3.25	2.75	3.5	3.1	1.9	2.45	1.9	2.05	1.95	1.9
20	2.6	2.1	3.3	2.8	3.3	2.9	1.95	2.45	1.9	2.1	1.85	1.8
21	2.6	2.2	3.25	2.95	3.25	2.7	2.0	2.65	1.95	2.1	1.85	1.9
22	2.55	2.25	3.2	2.9	3.35	2.75	2.0	2.7	2.05	2.15	1.8	1.9
23	2.6	2.2	3.25	2.95	3.55	2.7	2.0	2.7	2.05	2.15	1.75	1.8
24	2.2	2.2	3.2	3.0	3.6	2.65	2.2	2.7	2.05	2.1	1.85	1.95
25	2.2	2.0	3.05	3.05	3.55	2.65	2.6	2.25	2.0	2.1	1.85	2.0
26	2.2	2.1	3.0	3.05	3.4	2.5	2.55	2.05	2.0	2.05	1.75	1.95
27	2.0	2.1	2.85	3.1	3.4	2.45	2.55	2.05	2.0	2.0	1.7	1.9
28	2.1	2.0	2.75	3.15	3.45	2.4	2.6	2.05	2.0	2.0	1.55	1.9
29	2.2	.....	2.75	3.25	3.45	2.4	3.3	2.1	2.0	2.05	1.6	1.9
30	2.1	.....	2.6	3.3	3.4	2.75	3.25	2.0	2.0	2.0	1.55	1.9
31	2.15	.....	2.55	.....	3.4	.....	3.4	2.0	.....	1.95	.....	1.9
1911.												
1	.....	1.6	1.65	1.6	2.15	2.75	3.15	2.35	2.1	2.0	1.65	.....
2	.....	1.55	1.6	1.9	2.1	2.85	3.4	2.3	2.25	1.95	1.6	.....
3	2.05	1.55	1.55	2.2	2.0	2.85	3.75	2.35	2.2	1.85	1.65	.....
4	2.0	1.55	1.6	2.35	2.0	2.85	3.4	2.45	2.15	2.05	1.75	.....
5	2.05	1.6	1.6	2.4	2.1	2.9	3.55	2.95	2.15	2.1	1.75	1.25
6	1.9	1.55	1.6	2.4	2.2	2.8	3.9	2.9	2.1	2.3	1.65	1.7
7	1.7	1.6	1.55	2.25	2.3	2.8	3.95	2.75	2.05	2.0	1.65	1.75
8	1.65	1.55	1.6	2.1	2.4	2.75	4.3	2.35	2.0	1.9	1.7	1.3
9	1.75	1.55	1.6	2.05	2.45	2.85	4.25	2.8	2.0	1.8	1.7	1.1
10	2.0	1.55	1.6	1.9	2.55	2.75	4.2	2.85	1.95	1.7	1.75	1.1

Daily gage height, in feet, of South Platte River at South Platte, Colo., for 1910–11—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
11	2.0	1.6	1.65	1.85	2.2	2.7	4.2	2.9	1.9	1.65	1.75	.....
12	1.95	1.6	1.5	1.85	2.05	2.7	4.15	2.45	1.8	1.6	1.6	.....
13	1.85	1.6	1.45	1.8	2.35	2.7	4.2	2.35	1.8	1.6	1.55	.....
14	1.7	1.55	1.45	1.8	2.35	2.65	4.2	2.3	1.8	1.6	1.75	.....
15	1.65	1.55	1.45	1.7	2.55	2.7	4.15	2.3	1.8	1.6	1.65	.....
16	1.65	1.6	1.55	1.75	2.6	2.85	4.15	2.3	1.8	1.6	1.65	.....
17	1.65	1.6	1.55	1.8	2.6	2.9	4.2	2.3	1.8	1.6	1.6	.....
18	1.55	1.6	1.5	1.75	2.65	2.8	3.2	2.35	1.85	1.6	1.6	.....
19	1.6	1.55	1.55	1.8	2.75	2.8	2.85	2.25	1.85	1.6	1.65	.....
20	1.6	1.45	1.45	1.8	2.7	2.8	3.5	2.2	1.85	1.55	1.6	.....
21	1.65	1.45	1.5	1.8	2.9	3.0	3.5	2.2	1.85	1.55	1.6	.....
22	1.7	1.8	1.55	1.9	3.0	2.9	3.55	2.45	1.85	1.55	1.65	.....
23	1.55	2.0	1.5	1.95	3.0	3.0	3.6	2.75	1.85	1.6	1.5	.....
24	1.65	2.05	1.5	2.1	3.0	3.0	3.55	2.7	1.8	1.65	1.5	.....
25	1.7	2.0	1.55	2.2	3.0	3.0	3.55	2.7	1.8	1.65	1.6	.....
26	1.7	1.7	1.5	2.2	3.05	3.0	3.6	2.6	1.85	1.65	1.7	.....
27	1.6	1.6	1.4	2.15	2.95	3.0	3.35	2.1	1.85	1.65	1.65	.....
28	1.6	1.65	1.5	2.1	2.8	3.05	3.15	2.1	1.85	1.65	.....	.....
29	1.6	.....	1.45	2.2	2.75	3.05	3.1	2.0	1.85	1.7	.....	.....
30	1.65	.....	1.5	2.3	2.65	3.15	2.85	2.0	1.95	1.65	.....	.....
31	1.6	.....	1.55	.....	2.6	.....	2.45	2.05	.....	1.65	.....	.....

NOTE.—Ice present Jan. 1 to 23 and Dec. 16 to 31, 1910. Gage heights for 1910, published in Water-Supply Paper 286, are in error as necessary corrections were not applied; corrected gage heights presented in above table.

Ice present Jan. 1 to Feb. 26 and Nov. 26 to Dec. 31, 1911.

Daily discharge, in second-feet, of South Platte River at South Platte, Colo., for 1910–11.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1910.												
1	200	182	160	354	605	600	388	400	182	162	136	68
2	200	206	182	370	600	600	388	610	194	162	126	68
3	200	182	234	370	600	598	420	660	182	160	126	83
4	200	160	234	322	635	598	404	610	194	160	126	83
5	200	160	322	322	630	540	404	545	182	150	146	68
6	225	160	354	306	570	540	388	560	160	155	136	68
7	225	120	338	322	550	576	373	510	150	155	136	68
8	225	120	370	322	530	558	343	430	150	160	156	83
9	225	120	386	322	530	540	313	365	171	155	156	83
10	225	111	710	322	548	522	197	630	171	153	156	90
11	215	120	710	338	548	505	186	630	150	158	167	83
12	215	120	650	354	560	522	175	670	150	152	167	83
13	215	130	610	386	600	488	175	650	160	130	156	98
14	215	140	610	440	630	522	175	590	160	140	146	76
15	215	160	610	422	625	488	186	276	160	160	156	70
16	210	182	610	370	615	505	186	248	160	180	156	70
17	210	160	590	386	590	522	186	290	160	195	136	70
18	210	171	610	386	665	505	186	322	160	178	146	70
19	210	182	590	404	650	488	153	306	160	176	146	70
20	210	206	610	422	572	420	164	306	160	190	126	70
21	205	234	590	476	555	358	175	370	171	190	126	75
22	205	248	570	458	590	373	175	386	194	200	116	75
23	205	234	590	476	660	358	175	386	194	200	107	75
24	205	234	570	494	680	343	220	386	194	186	126	75
25	208	182	513	513	660	343	375	248	180	186	126	80
26	212	206	494	513	605	298	365	194	180	175	107	80
27	170	206	440	532	605	284	380	194	180	160	98	80
28	190	182	404	552	620	270	410	194	178	160	76	80
29	218	.....	404	590	620	270	670	206	178	170	83	85
30	195	.....	354	605	602	373	640	182	178	160	76	85
31	205	.....	338	.....	602	.....	690	182	.....	145	.....	85
1911.												
1	100	95	105	95	226	438	617	303	340	237	100	100
2	100	85	95	160	212	480	732	286	390	220	90	100
3	100	85	86	240	185	480	908	303	360	190	95	105
4	105	85	95	283	185	480	732	337	335	245	115	105
5	105	95	95	298	212	500	807	529	330	260	115	105

Daily discharge, in second-feet, of South Platte River at South Platte, Colo., for 1910–11—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907–8.												
6	110	85	95	298	240	460	986	508	310	320	95	105
7	115	95	86	254	268	460	1,010	446	290	225	95	115
8	105	85	95	212	298	440	1,200	303	270	195	105	115
9	105	85	95	198	314	485	1,180	466	270	170	105	115
10	110	85	95	160	347	445	1,150	487	250	140	115	115
11	110	95	105	148	238	428	1,150	508	235	130	115	115
12	110	95	77	148	195	428	1,120	337	210	115	85	115
13	110	95	70	137	283	426	1,150	303	205	115	77	115
14	115	86	70	137	283	408	1,150	286	205	110	115	115
15	105	86	70	115	355	426	1,120	286	200	110	95	115
16	105	95	86	126	370	487	1,120	286	200	108	95	115
17	105	95	86	137	370	508	1,150	286	200	108	85	110
18	85	95	77	126	392	466	640	303	210	105	85	110
19	95	100	86	137	430	466	487	280	210	103	95	110
20	95	100	70	137	412	466	782	280	210	95	85	110
21	105	105	77	137	490	550	782	290	210	92	85	110
22	115	105	86	160	535	508	807	390	205	92	95	110
23	85	105	77	172	535	550	832	525	205	100	70	110
24	105	110	77	212	535	550	807	515	190	110	70	105
25	115	110	86	240	535	550	807	535	190	110	85	105
26	115	115	77	240	560	550	832	510	200	110	85	105
27	95	95	63	226	515	550	709	335	200	108	90	105
28	95	105	77	212	455	572	617	345	200	105	95	105
29	95	.....	70	240	435	572	594	325	195	115	95	105
30	95	.....	77	268	400	617	487	325	220	105	100	105
31	95	.....	86	.....	380	.....	337	332	.....	105	.....	105

NOTE.—Daily discharge for this station for 1910, as published in Water-Supply Paper 286, in error because of noncorrection of gage heights and method of computing; corrected determination presented herewith: Daily discharge Jan. 1 to 23 and Dec. 16 to 31, 1910, estimated because of ice; discharge Feb. 16 to Apr. 27, June 6 to July 19, Aug. 12 to Sept. 24, and Nov. 1 to 22, 1910, determined from fairly well-defined curves; indirect method for shifting channels used for the remaining periods of 1910.

Daily discharge Jan. 1 to Feb. 26 and Nov. 26 to Dec. 31, 1911, estimated because of ice; discharge Feb. 27 to Aug. 18, 1911, determined from a curve fairly well defined between 50 and 1,200 second-feet; indirect method for shifting channels used from Aug. 19 to Nov. 25, 1911.

Monthly discharge of South Platte River at South Platte, Colo., for 1910–11.

[Drainage area, 2,610 square miles.]

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
January	225	170	209	12,800	C.
February	248	111	172	9,560	B.
March	710	160	437	26,900	B.
April	605	306	415	24,700	B.
May	680	530	602	37,000	B.
June	600	270	464	27,600	B.
July	690	153	312	19,200	B.
August	670	182	404	24,900	B.
September	194	150	171	10,200	B.
October	200	130	167	10,200	B.
November	167	76	131	7,800	B.
December	98	68	77.3	4,750	B.
The year	710	68	298	216,000	
1911.					
January	115	85	103	6,360	B.
February	115	85	95.4	5,300	B.
March	105	63	83.6	5,140	B.
April	298	95	188	11,200	A.
May	560	185	361	22,200	A.
June	617	408	492	29,200	A.
July	1,200	337	865	53,100	A.
August	535	280	373	22,900	A.
September	390	190	242	14,400	A.
October	320	92	144	8,830	A.
November	115	70	94.4	5,620	B.
December	115	100	109	6,700	C.
The year	1,200	63	264	191,000	

NOTE.—Monthly estimates for this station, for 1910, as published in Water Supply Paper 286, are in error, and therefore the revised estimates are published herewith.

SOUTH PLATTE RIVER AT DENVER, COLO.

Location.—At the Sixteenth Street viaduct in Denver; 500 feet below mouth of Cherry Creek.

Records available.—May 7, 1895, to December 31, 1911.

Drainage area.—3,840 square miles.

Gage.—Automatic recording gage installed August 12, 1909. The original gage was located at the Twenty-third Street viaduct. In July, 1895, a new gage was installed at the Fifteenth Street bridge. In August, 1898, an inclined staff gage was placed on the opposite side of the river, but referred to the same datum. This gage was destroyed by high water in June, 1900, and for the remainder of the year the gage installed in July, 1895, was used. This gage was stolen, and a new one was placed between the Fifteenth Avenue and Sixteenth Avenue bridges May 15, 1901, reading to the same datum. This gage also was stolen and was replaced on June 10, 1903, by a vertical staff near the same place and having the same datum. The automatic gage is referred to practically the same datum as the preceding vertical staff.

Channel.—Shifting.

Discharge measurements.—Made from the Fifteenth Street bridge during high water and by wading at low-water stages.

Winter flow.—The flow at this point is seldom affected by ice.

Diversions.—Between this station and the one at South Platte there are court decrees for diversion from South Platte River of 2,226 second-feet and from intervening tributaries of 1,466 second-feet.

Cooperation.—Since 1907 station has been maintained by the State engineer, by whom the records are furnished.

Discharge measurements of South Platte River at Denver, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 17	Turner and Clayton	1.18	179	July 31	Bundy and Bunger	1.46	341
Feb. 24	Thos. Grieve	1.08	110	Aug. 7	do	1.15	216
Mar. 11	F. Cogswell	1.10	110	14	Grieve and Bundy	1.28	216
Apr. 4	Turner and Clayton	1.33	177	21	Bundy and Bunger	1.35	230
May 1	Thos. Grieve	1.52	254	28	Hezmalhalch and Bunger	1.40	242
June 19	C. C. Hezmalhalch	1.69	331	Sept. 11	do	1.21	160
24	F. Cogswell	1.72	396	16	F. Cogswell	1.00	114
July 5	Bunger and Hezmalhalch	1.78	463	Oct. 2	Hezmalhalch and Bunger	1.03	111
11	Bundy and Bunger	1.93	591	30	do	.89	89.0
24	Bunger and Hezmalhalch	2.16	750	Dec. 4	Grieve and Bunger	.74	71.0

Daily gage height, in feet, of South Platte River at Denver, Colo., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.85	0.95	1.1	0.9	1.4	1.55	1.65	1.25	1.2	1.1	0.95	0.95
2	.8	.9	1.15	.8	1.35	1.7	1.9	1.2	1.2	.95	.9	1.1
3	.8	.9	1.2	1.0	1.3	1.65	2.4	1.15	1.45	1.0	.9	.95
4	.85	.8	1.05	1.3	1.2	1.6	2.35	1.15	1.45	.9	.85	.8
5	1.0	.95	1.0	1,35	1.25	1.55	1.75	1.25	1.3	1.1	.85	.95
6	1.1	1.0	1.0	1.4	1.25	1.6	1.8	1.25	1.3	1.25	.85	.9
7	1.1	.9	1.1	1.5	1.3	1.45	2.3	1.15	1.3	1.2	.90	1.05
8	1.15	.9	1.05	1.5	1.35	1.55	2.1	.95	1.2	1.05	.9	1.15
9	1.1	.9	1.0	1.25	1.4	1.6	2.15	1.05	1.2	1.0	.9	1.1
10	1.15	.95	1.05	1.15	1.45	1.6	2.0	1.05	1.15	.95	.85	.95

Daily gage height, in feet, of South Platte River, at Denver, Colo., for 1911—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	1.1	.95	1.1	1.15	1.45	1.5	1.95	2.25	1.05	1.0	.8	.95
12	1.05	1.0	1.0	1.05	1.4	1.5	1.85	2.0	1.05	.95	.8	.9
13	1.05	1.0	.9	1.0	1.35	1.45	1.[illegible]	1.95	1.05	.85	1.0	.8
14	1.1	1.0	.95	1.05	1.4	1.5	1.[illegible]5	1.3	1.0	.85	1.05	.8
15	1.05	1.0	.85	1.05	1.4	1.[illegible]	1.95	1.35	1.05	.9	1.05	.9
16	1.0	.95	.9	1.0	1.5	1.75	2.2	1.3	1.1	.95	1.05	.9
17	1.05	1.0	.9	1.0	1.5	2.05	2.35	1.25	.95	.95	1.1	.95
18	1.05	1.0	.9	.95	1.5	2.2	2.25	1.25	.9	.95	.95	1.0
19	1.0	1.05	.8	.95	1.4	1.7	1.55	1.3	.95	.95	.9	1.0
20	1.0	1.0	.9	.9	1.6	1.7	1.55	1.3	.95	1.0	.85	.95
21	1.0	.85	.85	.95	1.5	1.7	1.7	1.3	.95	.9	.85	.9
22	1.0	.75	.85	.95	1.5	1.9	1.65	1.3	.9	.85	.75	.9
23	.9	.75	.85	1.0	1.35	1.85	1.65	1.5	.9	.95	.75	.95
24	1.0	1.1	.9	1.05	1.4	1.8	2.15	1.85	.85	.9	.8	.95
25	1.05	1.3	.9	1.15	1.35	1.7	2.2	1.9	.9	.9	.9	.9
26	1.1	1.25	.8	1.1	1.4	1.65	2.2	1.95	.85	.85	.85	.85
27	1.1	1.2	.9	1.1	1.45	1.7	2.1	1.7	.9	.95	.85	.7
28	1.0	1.1	.85	1.15	1.35	1.7	1.95	1.4	.95	.9	.75	.75
29	1.0	.....	.85	1.2	1.4	1.7	1.8	1.3	.95	.9	.75	.9
30	1.0	.....	.8	1.45	1.5	1.6	1.65	1.3	1.0	.95	.85	.9
31	1.0	.....	.9	.....	1.45	.....	1.45	1.2	.....	.9	.....	.9

Daily discharge, in second-feet, of South Platte River at Denver, Colo., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	78	102	115	70	205	268	390	250	165	135	100	100
2	65	85	128	55	188	335	510	230	165	100	90	135
3	65	85	140	90	170	312	815	215	250	110	90	100
4	78	60	102	170	140	290	780	215	250	90	82	75
5	115	95	90	188	155	268	450	250	195	135	82	100
6	150	110	90	205	155	290	475	250	195	180	82	90
7	150	80	115	245	170	225	760	215	195	165	90	122
8	168	80	102	245	188	268	640	145	165	122	90	150
9	150	80	90	155	205	290	680	165	165	110	90	135
10	168	90	102	132	225	290	630	160	150	100	82	100
11	150	90	115	132	225	245	602	650	122	110	75	100
12	132	105	90	102	205	245	540	570	122	100	75	90
13	132	105	70	90	188	225	570	520	122	82	110	75
14	150	105	80	102	205	245	602	195	110	82	122	75
15	132	100	62	102	205	245	602	212	122	90	122	90
16	115	85	70	90	245	360	770	195	135	100	122	90
17	132	95	70	90	245	532	890	180	100	100	135	100
18	132	95	70	80	245	630	810	180	90	100	100	110
19	115	110	55	80	205	335	378	195	100	100	90	110
20	115	90	70	70	290	345	378	195	100	110	82	100
21	115	55	62	80	245	350	455	195	100	90	82	90
22	115	50	62	80	245	470	428	195	90	82	68	90
23	90	50	62	90	188	455	428	270	90	100	68	100
24	115	115	70	102	205	435	735	432	82	90	75	100
25	132	170	70	128	188	390	770	460	90	90	90	90
26	150	155	55	115	205	370	770	490	82	82	82	82
27	150	140	70	115	225	400	700	355	90	100	82	62
28	115	115	62	128	188	400	602	230	100	90	68	68
29	115	.....	62	140	205	400	510	195	100	90	68	90
30	115	.....	55	225	245	365	428	195	110	100	82	90
31	115	.....	70	.....	225	.....	332	165	.....	90	.....	90

Monthly discharge of South Platte River at Denver, Colo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	168	65	123	7,580
February	170	50	96	5,350
March	140	55	81	5,010
April	245	55	123	7,330
May	290	140	207	12,700
June	630	225	343	20,400
July	890	332	595	36,600
August	650	145	270	16,600
September	650	145	132	7,840
October	180	82	104	6,400
November	135	68	89	5,310
December	150	62	98	5,950
The year	890	50	189	137,000

SOUTH PLATTE RIVER NEAR KERSEY, COLO.

Location.—At highway bridge in sec. 9, T. 5 N., R. 64 W., 1¾ miles north of Kersey, 2 miles below the entrance of Lone Tree Creek, an intermittent stream, and 3 miles below the mouth of Cache la Poudre River.

Records available.—April 27, 1901, to October 31, 1903; March 1, 1905, to December 31, 1911.

Drainage area.—9,500 square miles.

Gage.—A chain gage, placed in the fall of 1906 in each of the two channels in which the river flows. These gages were referred to a datum slightly different from that of the original gage, but have remained permanent since. The original gage, a vertical staff, was used until June 14, 1906, when the observer moved it 20 feet south. This gage was placed 0.30 foot too high, and all readings were corrected by that amount until the chain gages were placed in position.

Channel.—Shifting.

Discharge measurements.—Made from the bridge during high water and by wading at ordinary stages.

Winter flow.—Ice causes slight backwater for a few days during the winter.

Diversions.—Between this station and Denver there are court decrees for diversions of 3,764 second-feet from the South Platte, and 17,000 second-feet from intervening tributaries, besides numerous flood-water decrees.

Accuracy.—Although the channel is shifting, sufficient discharge measurements have been obtained to enable estimates of flow to be made which may be regarded as reliable.

Cooperation.—Station maintained in cooperation with the State engineer.

Discharge measurements of South Platte River near Kersey, Colo., in 1911.

Date.	Hydrographer.	Gage No. 2.		Date.	Hydrographer.	Gage No. 1.	
		Gage height.	Discharge.			Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 30	R. H. Fletcher	2.74	263	Jan. 30	R. H. Fletcher	2.78	160
Feb. 25	E. O. Christiansen	2.65	277	Feb. 25	E. O. Christiansen	2.58	125
Mar. 4	R. H. Fletcher	3.04	338	Mar. 4	R. H. Fletcher	2.98	188
27	do	2.30	149	27	do	2.38	81.3
Apr. 20	do	1.36	26.9	Apr. 20	do	1.98	37.0
May 27	R. C. Miles	1.40	32.4	May 27	R. C. Miles	1.96	43.3
June 27	E. O. Christiansen	1.74	55.2	June 27	E. O. Christiansen	2.11	47.2
July 13	G. H. Russell	1.90	78.5	July 13	G. H. Russell	2.15	58.8
Aug. 14	R. H. Fletcher	2.25	96.0	Aug. 14	R. H. Fletcher	2.27	67.5
Sept. 14	G. H. Russell	1.63	37.7	Sept. 14	G. H. Russell	2.13	53.6
Oct. 31	do	2.90	234	Oct. 31	do	2.80	140
Dec. 13	R. H. Fletcher	2.82	197	Dec. 13	R. H. Fletcher	2.80	154

Daily gage height, in feet, of South Platte River at gages Nos. 1 and 2 near Kersey, Colo., for 1911.

[Mrs. J. C. Maisner, observer.]

Gage No. 1.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.75	2.8	2.85	2.25	2.02	2.4	2.18	2.0	2.0	2.1	2.78	2.9
2	2.85	2.8	2.9	2.3	2.05	2.4	2.2	2.5	2.5	2.1	2.68	2.9
3	3.25	2.75	2.95	2.3	2.02	2.4	2.22	2.5	2.5	2.1	2.6	2.9
4	3.42	2.72	2.95	2.3	2.0	2.0	2.25	2.5	2.5	2.1	2.6	2.9
5	3.52	2.7	2.95	2.3	2.1	2.0	2.6	2.5	2.5	2.1	2.65	2.9
6	3.35	2.7	2.9	2.18	2.1	2.0	3.2	2.5	2.5	2.1	2.65	2.88
7	2.95	2.7	2.7	2.2	2.12	2.0	2.88	2.5	2.5	2.1	2.65	2.82
8	3.0	2.7	2.62	2.2	2.3	2.25	2.82	2.5	2.3	2.1	2.7	2.85
9	2.9	2.7	2.55	2.18	2.3	2.25	2.8	2.0	2.1	2.1	2.8	2.85
10	3.3	2.65	2.5	2.1	2.3	2.02	2.72	2.5	2.1	2.1	2.9	2.8
11	3.2	2.6	2.5	2.08	2.2	2.4	2.56	2.3	2.1	2.35	2.9	2.8
12	3.12	2.52	2.5	2.15	1.9	2.2	2.28	2.3	2.3	2.55	2.98	2.78
13	3.5	2.5	2.45	2.1	2.4	2.4	2.14	2.28	2.1	2.82	3.25	2.8
14	3.25	2.5	2.4	2.1	2.2	2.5	2.1	2.22	2.1	2.92	3.1	2.8
15	2.9	2.5	2.4	2.1	2.3	2.62	2.1	2.3	2.12	2.95	3.15	2.9
16	2.9	2.45	2.4	2.2	2.25	2.6	2.1	2.25	2.1	3.0	3.15	2.8
17	2.85	2.4	2.4	2.5	2.0	2.45	2.1	2.25	2.12	3.0	3.1	2.8
18	2.85	2.4	2.4	2.5	2.0	2.58	2.1	2.25	2.1	3.0	3.5	2.8
19	2.85	2.42	2.35	2.0	2.0	2.35	2.22	2.25	2.1	3.0	3.25	2.8
20	2.8	2.5	2.35	2.0	2.0	2.15	2.55	2.25	2.1	3.0	3.0	2.8
21	2.8	2.5	2.35	1.9	1.9	2.18	2.18	2.3	2.1	3.0	3.5	2.82
22	2.8	2.5	2.3	2.0	1.9	2.3	2.15	2.3	2.1	3.0	3.5	2.92
23	2.8	2.5	2.3	2.0	2.4	2.3	2.12	2.5	2.1	3.0	2.98	2.9
24	2.8	2.5	2.3	2.0	2.4	2.25	2.1	2.5	2.1	2.9	2.88	2.85
25	2.8	2.55	2.3	2.0	2.5	2.2	2.1	2.5	2.3	2.7	2.85	2.85
26	2.8	2.65	2.35	1.9	2.0	2.2	2.1	2.3	2.55	2.7	2.8	2.82
27	2.8	2.7	2.4	2.0	2.0	2.15	2.1	2.2	2.5	2.8	2.82	2.8
28	2.8	2.8	2.4	2.5	2.0	2.15	2.1	2.3	2.5	2.8	2.88	3.75
29	2.75	.....	2.4	2.1	2.0	2.18	2.25	2.22	2.1	2.8	2.85	3.58
30	2.75	.....	2.4	2.1	2.0	2.21	2.5	2.1	2.1	2.8	2.85	3.3
31	2.8	.....	2.35	.....	2.15	.....	2.25	2.3	.....	2.82	.....	3.22

Gage No. 2.

1	.....	2.9	3.0	2.3	1.58	1.5	1.85	1.65	1.7	1.8	2.85	2.9
2	.....	2.9	3.0	2.22	1.6	1.52	1.85	1.68	1.7	1.8	2.75	2.92
3	.....	2.85	3.32	2.2	1.52	1.5	1.92	1.68	1.75	1.8	2.7	2.9
4	.....	2.85	3.32	2.2	1.5	1.5	1.98	1.7	1.75	1.8	2.65	2.85
5	.....	2.8	3.0	2.2	1.5	1.5	2.4	1.7	1.7	1.9	2.65	2.85
6	3.4	2.8	2.95	2.18	1.5	1.5	3.32	1.7	1.7	1.95	2.65	2.85
7	3.3	2.8	2.7	2.1	1.42	1.5	2.85	1.7	1.7	1.92	2.7	2.8
8	3.18	2.8	2.68	2.1	1.38	1.52	2.75	1.7	1.7	1.9	2.78	2.8
9	3.22	2.8	2.5	2.5	1.3	1.52	2.75	1.65	1.7	1.92	2.92	2.8
10	3.22	2.75	2.45	2.0	1.32	1.72	2.68	1.62	1.7	1.92	3.0	2.8
11	3.3	2.7	2.45	1.92	1.3	1.58	2.45	1.7	1.68	2.45	3.0	2.8
12	3.25	2.62	2.4	1.8	1.3	1.6	2.32	1.75	1.65	2.8	3.5	2.78
13	3.2	2.6	2.35	1.62	1.3	1.55	1.95	2.22	1.62	3.0	3.1	2.8
14	3.15	2.58	2.35	1.65	1.3	1.55	1.88	2.15	1.6	3.0	3.2	2.75
15	3.1	2.52	2.3	1.62	1.32	2.2	1.85	1.78	1.62	3.0	3.25	2.68
16	3.3	2.5	2.3	1.6	1.35	2.68	1.8	1.7	1.6	3.0	3.25	2.78
17	2.95	2.5	2.28	1.55	1.3	2.48	1.8	1.72	1.62	3.0	3.18	2.8
18	2.9	2.5	2.25	1.5	1.28	2.62	1.8	1.72	1.6	3.5	3.1	2.8
19	3.0	2.5	2.28	1.45	1.35	2.25	2.05	1.7	1.6	3.5	3.1	2.85
20	2.92	2.55	2.25	1.42	1.35	2.0	2.28	1.7	1.65	3.5	3.1	2.85
21	2.9	2.5	2.25	1.3	1.45	2.15	2.02	1.7	1.65	3.5	3.1	2.85
22	2.9	.....	2.2	1.3	1.4	2.28	1.98	1.7	1.65	3.5	3.3	2.98
23	2.9	.....	2.2	1.3	1.52	2.3	1.85	1.7	1.7	3.0	2.95	2.92
24	2.9	.....	2.2	1.3	1.55	2.22	1.8	1.7	1.7	2.88	2.9	2.9
25	2.9	2.62	2.2	1.3	1.55	1.88	1.8	1.7	1.7	2.68	2.8	2.85
26	2.9	2.75	2.25	1.3	1.4	1.85	1.82	1.72	1.7	2.65	2.8	2.9
27	2.9	.....	2.3	1.3	1.4	1.7	1.78	2.02	1.75	2.8	2.78	2.9
28	2.9	2.95	2.32	1.3	1.45	1.68	1.78	2.28	1.72	2.8	2.85	3.95
29	2.85	.....	2.35	1.4	1.5	1.65	1.72	2.22	1.75	2.85	2.8	3.95
30	2.85	.....	2.35	1.5	1.5	1.82	1.72	2.25	1.75	2.9	2.82	3.85
31	2.88	.....	2.3	.....	1.5	.....	1.68	1.85	.....	2.9	.....	3.72

NOTE.—Gage No. 1: Ice present Jan. 1 to 14 and Dec. 28 to 31. Gage No. 2: Ice present Jan. 1 to 16 and Dec. 28 to 31.

Daily discharge, in second-feet, of South Platte River at gages No. 1 and No. 2 near Kersey, Colo., for 1911.

Gage No. 1.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	154	167	167	67	40	77	56	46	46	50	139	170
2	178	167	177	72	42	77	57	90	90	50	119	170
3	180	156	187	72	41	77	59	90	90	50	103	170
4	180	144	183	73	40	46	62	90	90	50	103	170
5	180	144	183	73	45	46	103	90	90	50	113	170
6	180	144	170	60	45	46	257	90	90	50	113	165
7	180	144	128	61	45	46	165	90	90	50	113	148
8	180	144	112	61	62	62	148	90	67	50	123	156
9	185	144	104	59	62	62	143	46	50	50	143	156
10	185	134	92	53	62	47	127	90	50	50	170	143
11	185	125	92	51	54	77	98	67	50	72	170	143
12	185	108	92	55	40	57	65	67	67	96	192	139
13	185	108	87	51	74	77	53	65	50	148	272	143
14	185	108	80	50	53	90	50	59	50	175	226	143
15	190	108	80	48	62	107	50	67	51	184	242	170
16	190	102	81	53	67	103	50	62	50	197	242	143
17	178	95	82	85	42	84	50	62	51	197	226	143
18	178	95	82	85	42	100	50	62	50	197	356	143
19	178	98	75	40	43	72	59	62	50	197	272	143
20	167	108	75	38	43	54	96	62	50	197	197	143
21	167	108	76	36	42	56	56	67	50	197	356	148
22	167	108	71	38	42	67	54	67	50	197	356	175
23	167	108	71	38	73	67	51	90	50	197	192	170
24	167	108	72	38	73	62	50	90	50	170	165	156
25	167	116	72	38	85	57	50	90	67	123	156	156
26	167	130	77	36	45	57	50	67	96	123	143	148
27	167	140	85	38	46	54	50	57	90	143	148	143
28	167	158	85	84	46	54	50	67	90	143	165	143
29	156	.....	85	45	46	56	62	59	50	143	156	143
30	156	.....	85	45	46	58	90	50	50	143	156	143
31	167	.....	78	.....	54	.....	62	67	.....	148	.....	143

Gage No. 2.

1	250	302	335	146	42	36	72	42	40	47	211	223
2	250	302	335	131	44	38	72	45	40	47	188	228
3	250	286	465	127	38	36	81	45	44	47	177	223
4	250	286	465	127	36	36	90	45	44	47	167	211
5	250	271	335	127	36	36	167	45	40	55	167	211
6	250	271	318	123	36	36	465	43	40	60	167	211
7	250	271	242	109	31	36	286	43	40	57	177	199
8	250	271	237	109	29	38	256	43	40	55	195	199
9	250	271	190	190	26	38	236	41	40	57	228	199
10	275	256	178	93	27	56	237	35	40	57	250	199
11	275	242	178	81	26	42	178	42	39	130	250	199
12	275	220	167	66	26	44	150	45	36	199	430	195
13	275	215	156	46	26	40	86	93	34	250	280	199
14	275	210	156	49	26	40	75	84	33	250	315	188
15	275	195	146	46	27	127	72	46	34	250	332	173
16	275	190	146	44	28	237	65	40	33	250	332	195
17	318	190	142	40	26	190	65	41	34	250	308	199
18	302	190	136	36	25	220	65	41	33	430	280	199
19	335	190	142	33	28	137	96	40	33	430	280	211
20	309	202	136	31	28	93	133	40	36	430	280	211
21	302	190	136	26	33	118	80	40	36	430	280	211
22	302	203	127	26	30	142	80	40	36	430	362	245
23	302	225	127	26	38	146	65	40	40	250	236	228
24	302	250	127	26	40	131	60	40	40	218	223	223
25	302	267	127	26	40	76	58	40	40	173	199	211
26	302	290	136	26	30	72	60	41	40	167	199	223
27	302	305	146	26	30	54	55	67	44	199	195	223
28	302	315	150	26	33	52	55	102	41	199	211	223
29	286	.....	156	30	36	49	50	94	44	211	199	223
30	286	.....	156	36	36	68	50	98	44	223	204	223
31	296	.....	146	.....	36	.....	45	51	.....	223	.....	223

NOTE.—Gage No. 1: Daily discharge Jan. 1 to 14 and Dec. 28 to 31 estimated because of ice; discharge Jan. 15 to Feb. 25 and May 27 to Dec. 27 determined from a curve fairly well defined between 45 and 250 second-feet; discharge Feb. 26 to May 26 computed by indirect method for shifting channels.

Gage No. 2: Daily discharge Jan. 1 to 16 and Dec. 28 to 31 estimated because of ice; discharge Jan. 17 to Feb. 21, Mar. 1 to July 13, and Aug. 15 to Dec. 27 determined from a rating curve fairly well defined between 20 and 400 second-feet; discharge Feb. 22 to Feb. 28 and July 14 to Aug. 14 computed by indirect method for shifting channels.

Daily discharge, in second-feet, of South Platte River near Kersey, Colo., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	404	469	502	213	82	113	128	88	86	97	350	393
2	428	469	512	203	86	115	129	135	130	97	307	398
3	430	442	652	199	79	113	140	135	134	97	280	393
4	430	430	648	200	76	82	152	135	134	97	270	381
5	430	415	518	200	81	82	270	135	130	105	280	381
6	430	415	488	183	81	82	722	133	130	110	280	376
7	430	415	370	170	76	82	451	133	130	107	290	347
8	430	415	349	170	91	100	404	133	107	105	318	355
9	435	415	294	249	88	100	399	87	90	107	371	355
10	460	390	270	146	89	103	364	125	90	107	420	342
11	460	367	270	132	80	119	276	109	89	202	420	342
12	460	328	259	121	66	101	215	112	103	295	622	334
13	460	323	243	97	100	117	139	158	84	398	552	342
14	460	318	236	99	79	130	125	143	83	425	541	331
15	465	303	226	94	89	234	122	113	85	434	574	343
16	465	292	227	97	95	340	115	102	83	447	574	338
17	496	285	224	125	68	274	115	103	85	447	534	342
18	480	285	218	121	67	320	115	103	83	427	636	342
19	513	288	217	73	71	209	155	102	83	427	552	354
20	476	310	211	69	71	147	229	102	86	427	477	354
21	469	298	212	62	75	174	136	107	86	427	636	359
22	469	311	198	64	72	209	134	107	86	427	718	420
23	469	333	198	64	111	213	116	130	90	447	428	398
24	469	358	199	64	113	193	110	130	90	388	388	379
25	469	383	199	64	125	133	108	130	107	296	355	367
26	469	420	213	62	75	129	110	108	136	290	342	371
27	469	445	231	64	76	108	105	124	134	342	343	366
28	469	473	235	110	79	106	105	169	131	342	376	366
29	442	.....	241	75	82	105	112	153	94	354	355	366
30	442	.....	241	81	82	126	140	148	94	366	360	366
31	463	.....	224	.....	90	.....	107	118	.....	371	.....	366

NOTE.—Determinations of daily discharge presented in above table represent the combined flow in the two channels.

Monthly discharge of South Platte River near Kersey, Colo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	513	404	456	28,000
February	473	285	371	20,600
March	652	198	301	18,500
April	249	62	122	7,280
May	125	66	83.7	5,150
June	340	82	149	8,840
July	722	105	195	12,000
August	169	88	123	7,560
September	136	83	102	6,100
October	447	97	291	17,900
November	718	270	432	25,700
December	420	331	363	22,300
The year	722	62	249	180,000

NOTE.—These estimates represent the combined flow of both channels.

SOUTH PLATTE RIVER AT JULESBURG, COLO.

Location.—At highway bridge 1 mile south of Julesburg, about sec. 33, T. 12 N., R. 44 W. No important tributaries between the station and the Colorado-Nebraska State line, 1 mile distant. All the tributaries for 100 miles or more above the station are intermittent.

Records available.—April 2, 1902, to November 16, 1906; May 12, 1908, to December 31, 1911.

Drainage area.—20,600 square miles.

Gage.—When the station was reestablished in 1908 a gage was placed in each of the two main channels; both gages read practically the same as the original gage on the lower bridge 2,000 feet below the present site. The datum of the gages has remained unchanged.

Channel.—Shifting.

Discharge measurements.—Made from the pile bridge during high water, and by wading at low-water stages.

Winter flow.—Ice causes backwater during the winter months and measurements are made to determine the flow.

Diversions.—Between Kersey and Julesburg there are court decrees for diversions of 5,316 second-feet from the South Platte, and diversions of 1,240 second-feet from intervening tributaries including Lodgepole Creek in Wyoming and Nebraska and Crow Creek in Wyoming, besides numerous flood decrees. Between the State line and the mouth diversions of 206 second-feet from the South Platte have been granted in Nebraska.

Accuracy.—Although the channel is shifting, sufficient measurements have been made to give fairly reliable discharge estimates.

Cooperation.—During 1911 this station was maintained in cooperation with the State engineer.

Discharge measurements of South Platte River at Julesburg, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 31[a]	R. H. Fletcher	2.46	683	July 14	G. H. Russell	0.85	4.6
Mar. 28	do	1.10	39.0	Aug. 15	R. H. Fletcher	[b] .85	7.2
Apr. 21	do	.96	16.5	Sept. 15	G. H. Russell	.82	12.7
May 26	R. C. Miles	.90	17.9	Oct. 31	do	1.07	29.6
June 28	E. O. Christiansen	.90	7.5	Dec. 14[a]	R. H. Fletcher	1.04	17.1

[a] Ice present.
[b] Gage height to ground-water level caused by seepage. Gage 40 feet from edge of first channel.

Daily gage height, in feet, of South Platte River at Julesburg, Colo., for 1911.

[Elva McSparian, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.2	2.3	2.0	1.1	1.3	1.0	0.8	0.8	1.0	0.8	1.1	1.0
2	2.2	2.2	2.3	1.1	1.2	1.0	.8	.8	1.0	.8	1.1	1.0
3	2.2	2.2	2.2	1.1	1.2	.9	.8	.8	1.0	.8	1.1	.....
4	2.3	2.0	2.0	1.1	1.2	.9	.8	.8	1.0	.9	1.1	.....
5	2.4	2.0	1.5	1.1	1.2	.9	.8	.8	1.0	.9	1.1	.....
6	2.4	2.0	1.6	1.1	1.1	.9	.8	.8	1.0	.9	1.1	.....
7	2.4	2.0	1.6	1.1	1.1	.9	.8	.8	.9	.9	1.1	.....
8	2.8	2.0	1.6	1.0	1.1	.9	.8	.8	.9	.9	1.1	.....
9	2.8	1.9	1.5	1.0	1.1	.9	.8	.8	.9	1.0	1.1	.....
10	2.8	2.0	1.4	1.0	1.0	.9	.8	.8	.9	1.0	1.1	.....
11	2.8	1.9	1.4	1.0	1.0	.9	.8	.8	.9	1.0	1.1	.....
12	2.8	1.9	1.3	1.0	1.0	.9	.8	.8	.9	1.0	1.1	.....
13	2.8	1.9	1.3	1.0	1.0	.9	.8	.8	.9	1.0	1.1	.....
14	2.8	1.8	1.2	1.0	.9	.9	.8	.8	.9	1.0	1.0	.....
15	2.8	1.8	1.2	1.0	.9	1.0	.8	.8	.8	1.0	1.0	.....
16	2.8	1.7	1.2	1.0	.9	1.3	.8	.8	.8	1.0	1.0	.....
17	2.8	1.7	1.1	1.0	.9	1.2	.8	.8	.8	1.0	1.0	1.0
18	2.8	1.6	1.1	1.0	.9	1.1	.8	.....	.8	1.0	1.0	1.0
19	2.8	1.6	1.1	1.0	.9	1.0	.8	1.7	.8	1.0	1.0	1.0
20	2.8	1.6	1.1	1.0	.9	1.0	.9	1.7	.8	1.0	1.0	1.0
21	2.8	1.6	1.1	.9	.9	.9	.....	1.6	.8	1.0	1.0	1.0
22	2.8	1.5	1.1	1.0	.9	.9	1.0	1.5	.8	1.0	1.0	1.0
23	2.8	1.5	1.1	1.0	.9	.9	1.0	1.4	.8	1.0	1.0	1.0
24	2.8	1.5	1.1	1.0	.9	.8	1.0	1.4	.8	1.0	1.0	1.0
25	2.8	1.8	1.0	1.0	.9	.8	.....	1.4	.8	1.0	1.0	1.0
26	2.8	2.0	1.1	1.0	.9	.8	.....	1.4	.8	1.0	1.0	1.0
27	2.7	2.0	1.0	1.0	.9	.8	.....	1.3	.8	1.1	1.0	1.0
28	2.7	2.0	1.2	.9	.9	.....	.....	1.2	.8	1.1	1.0	1.0
29	2.7	.....	1.2	.....	1.0	.8	.8	1.2	.8	1.1	1.0	1.0
30	2.7	.....	1.2	1.3	1.0	.....	.75	1.1	.8	1.1	1.0	1.0
31	2.5	.....	1.1	.....	1.0	.....	.8	1.0	.....	1.1	.....	.....

NOTE.—Ice present Jan. 4 to Feb. 1, Feb. 19 to Mar. 3, and Dec. 17 to 31.

Daily discharge, in second-feet, of South Platte River at Julesburg, Colo., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	230	680	670	34	75	21	8	8	21	8	34	21
2	230	675	670	34	52	21	8	8	21	8	34	21
3	230	670	670	34	52	12	8	8	21	8	34	21
4	300	670	670	34	52	12	8	8	21	12	34	21
5	350	670	153	34	52	12	8	8	21	12	34	21
6	350	670	210	34	34	12	8	8	21	12	34	21
7	350	670	210	34	34	12	8	8	12	12	34	19
8	700	670	210	21	34	12	8	8	12	12	34	19
9	700	510	153	21	34	12	8	8	12	21	34	19
10	700	670	112	21	21	12	8	8	12	21	34	19
11	700	510	112	21	21	12	8	8	12	21	34	19
12	700	510	81	21	21	12	8	8	12	21	34	19
13	700	510	81	21	21	12	8	8	12	21	34	19
14	700	375	57	21	12	12	8	8	12	21	21	18
15	700	375	57	21	12	21	8	8	8	21	21	18
16	700	270	57	21	12	75	8	8	8	21	21	18
17	700	270	38	21	12	52	8	8	8	21	21	18
18	700	195	38	21	12	34	8	25	8	21	21	18
19	700	195	38	21	12	21	8	270	8	21	21	18
20	700	195	38	21	12	21	12	270	8	21	21	18
21	700	195	38	12	12	12	21	195	8	21	21	18
22	700	142	38	21	12	12	21	142	8	21	21	18
23	700	142	38	21	12	12	21	105	8	21	21	18
24	700	142	38	21	12	8	21	105	8	21	21	18
25	700	375	24	21	12	8	21	105	8	21	21	18
26	700	670	38	21	12	8	21	105	8	21	21	18
27	685	670	24	21	12	8	12	75	8	34	21	18
28	685	670	52	12	12	8	12	52	8	34	21	18
29	685	.....	52	40	21	8	8	52	8	34	21	18
30	685	.....	52	75	21	8	7	34	8	34	21	18
31	685	.....	34	.....	21	.....	8	21	.....	34	.....	18

NOTE.—Daily discharge Jan. 4 to Feb. 1, Feb. 19 to Mar. 3, and Dec. 17 to 31, estimated from a mean curve with a very small range; discharge interpolated for days for which gage readings are missing.

Monthly discharge of South Platte River at Julesburg, Colo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	700	230	605	37,200	C.
February	680	142	463	25,700	C.
March	670	24	153	9,430	C.
April	75	12	25.9	1,540	C.
May	75	12	24.1	1,480	C.
June	75	8	16.7	996	C.
July	21	7	10.9	668	C.
August	270	8	54.6	3,360	C.
September	21	8	11.7	694	C.
October	34	8	20.4	1,250	C.
November	34	21	26.6	1,580	C.
December	21	18	18.2	1,120	C.
The year	700	7	118	85,000	

TARRYALL CREEK NEAR COMO, COLO.

Location.—At highway bridge in sec. 26, T. 8 S., R. 76 W., 1½ miles northeast of Como. No tributary within several miles of the station.

Records available.—July 21 to November 21, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Data too meager to determine.

Discharge measurements.—Made from bridge during high water and by wading during low water.

Winter flow.—Ice causes backwater during the winter months and the records are discontinued.

Diversions.—There are court decrees for diversions of 255 second-feet from Tarryall Creek above the station.

Accuracy.—Data insufficient for estimates of discharge.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of Tarryall Creek near Como, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
July 28	O. M. Wimmer	1.22	12.0
Sept. 5	Fletcher and Waha	.86	9.4
5	H. B. Waha	.86	5.8

Daily gage height, in feet, of Tarryall Creek near Como, Colo., for 1911.

[Roy Truman, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.	Nov.
1						16				1.0	
2						17					
3				.85		18					
4					1.1	19					
5			.9			20					
6			.86			21	2.1				.7
7						22		1.0	.9		
8		.9				23				1.2	
9						24					
10				.9		25					
11						26			.8		
12						27	1.85				
13					2.3	28					
14						29		.9			
15		.9	.9			30					
						31	1.0				

NOTE.—Ice caused backwater Nov. 13 to Dec. 31.

TARRYALL CREEK NEAR JEFFERSON, COLO.

Location.—At Robbins's ranch, in sec. 6, T. 9 S., R. 74 W., 10 miles southeast of Jefferson, a short distance above the mouth of Rock Creek.

Records available.—October 23, 1910, to June 30, 1911. At the latter date the station was discontinued and a new one established near Como.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Shifting.

Discharge measurements.—Made by wading.

Winter flow.—Ice causes backwater during the winter months.

Diversions.—There are court decrees for diversions of 309 second-feet from Tarryall Creek above the station, and for 898 second-feet from tributaries entering above.

Accuracy.—Data insufficient for estimates of discharge.

Cooperation.—Station was maintained in cooperation with the United States Forest Service.

Discharge measurements of Tarryall Creek near Jefferson, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 7	Fletcher and Truman	*a* 1.30	0
Apr. 23	O. M. Wimmer	1.30	46.0

a Gage height to top of ice. River frozen to bottom.

Daily gage height, in feet, of Tarryall Creek near Jefferson, Colo., for 1911.

[Roy Truman, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1		2.1	2.6		.75		16						
2						.65	17						1.6
3							18					.65	
4							19				1.0		
5						1.45	20						
6							21	1.7					
7	1.3						22						
8					.75		23				1.3		
9							24				1.1		
10							25				1.1		
11				1.05			26					.9	1.0
12							27						
13							28			2.5			.9
14							29						
15			2.7				30						
							31						

NOTE.—Creek frozen solid Jan. 7; water running over ice Jan. 21, Feb 1, and Mar. 1, 15, and 28.

TARRYALL CREEK NEAR HAYMAN, COLO.

Location.—At McLaughlin's ranch, in sec. 23, T. 11 S., R. 72 W., 6 miles northeast of Hayman post office, in the Pike National Forest. Nearest tributary a small stream entering from the north just below.

Records available.—October 23, 1910, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff. The datum was raised 0.28 foot in April, 1911, and all previous gage heights referred to the new datum.

Channel.—Apparently permanent.

Discharge measurements.—Made from the bridge during high water and by wading at ordinary stages.

Winter flow.—Ice causes backwater during the winter months.

Diversions.—There are court decrees for diversions of 205 second-feet from Tarryall Creek between this station and the one near Jefferson.

Accuracy.—As the station has not been completely rated, no estimates of discharge have been made.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of Tarryall Creek near Hayman, Colo., in 1910–11.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
1910.			
Oct. 23	S. T. Harding	0.52	9.3
Nov. 18	G. H. Russell	.62	13.3
1911.			
Jan. 11[a]	O. M. Wimmer	.32	1.6
Apr. 26	do	.92	33.3
July 9	E. O. Christiansen	1.95	133
Sept. 26	H. B. Waha	.55	12.4

[a] Ice conditions.

Daily gage height, in feet, of Tarryall Creek near Hayman, Colo., for 1910–11.

[F. C. Parrett, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1910.				1910.				1910.			
1				11				21			
2				12		0.62		22		0.57	0.42
3				13		.62		23		.52	
4				14				24			
5		0.72		15			0.52	25			
6			0.82	16				26			
7			.72	17				27	0.52		
8				18		.62		28			
9				19				29		.72	.32
10				20				30	.47		
								31			

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1911.												
1		0.5			0.94				0.7			
2								1.2				
3												
4			1.5				3.2			0.7		
5	0.4											
6		.7										
7									.7			
8				0.8								
9							1.95					
10											0.75	
11	.3	1.3			.3			.85				
12								.9		.8		
13												
14		1.5					1.3		.55	.75		
15											.7	
16			1.7									
17							1.2					
18								.8		.7		0.6
19	.2								.55			
20		1.0				0.90						
21			.4									
22											.65	
23		.8									.7	
24	.25							.9				
25							1.2				.85	
26				.9				.85	.55	.95		
27												
28										.9		
29			.9				1.3				.8	
30	.4											
31								.75				

JEFFERSON CREEK AT JEFFERSON, COLO.

Location.—At highway bridge at Jefferson, in sec. 8, T. 8 S., R. 75 W. Nearest tributary enters 1½ miles below.

Records available.—October 17, 1910, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff, which was lowered 0.66 foot. All readings have been referred to the latter datum.

Channel.—Shifting.

Discharge measurements.—Made from the bridge at high water, and by wading at ordinary stages.

Winter flow.—Ice causes backwater during the winter months.

Diversions.—There are court decrees for diversions from Jefferson Creek of 167 second-feet above the station and 21 second-feet below. There is a decree of 546 second-feet diversion from Jefferson Lake.

Accuracy.—Data insufficient for estimates of discharge.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of Jefferson Creek at Jefferson, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-feet.*
Jan. 6	R. H. Fletcher	[a] 2.10	0
Apr. 22	O. M. Wimmer	[b] .97	9.9
Sept. 7	R. H. Fletcher	.90	4.2
7	H. B. Waha	.90	3.8

[a] Gage height to top of ice. River frozen to bottom. [b] Gage height reduced to new datum.

Daily gage height, in feet, of Jefferson Creek at Jefferson, Colo., for 1911.

[R. M. Truman, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1				0.96					0.86	0.90		
2		3.21	3.21		0.68	0.56	0.96		.96	.90	0.90	
3					.71	1.36	.86	(a)	.91	.85		
4					.74	1.41		(a)	.96	.80	.90	
5					.68	1.16	.76	(a)	.91	1.00	.85	
6	2.76				.66		.81	0.76	.96	.95	.85	
7					.66	.56	.66	.76		.90	1.10	
8					.66		.66	1.06		.90	1.00	1.60
9					.67		.66	.76	.90	.90	.90	
10					.54		(a)	.56	.90	.85		
11					.51		.51	.61	.80	.85	1.20	
12			3.26		.51		.51	.61	.80	.85		
13					.48	.51	.66	1.06	.80	.85	1.05	
14					.51	.96	.86	1.06		.80		
15					.56	.96	.76	.96	.80	.85	1.00	
16		3.26			.54	.68	.76	.96	.80	.95		
17	3.06			1.16	.51	.76	.56		.80		.90	
18					.54	.68	.51	.96	.80	.80	1.20	
19						.68	.51	.96		.90		
20			3.26					.96	.85	.90	1.10	
21					.56		.56			.90	1.00	
22				.97	.51	.66	.61	1.06	.80	.95	1.10	
23				.96	1.06	.76	.61	1.06		1.00	1.10	
24				.76	.86	.66	.61	.96	.80	.90	1.10	
25					.91	.66	.76	.96		1.00	1.20	
26				.81	.51		.76		.80	.95		
27				.87	.51		.56			1.00	1.20	
28				.86	.53	.54	.54	.96	.85	.92		
29					.54	.56	.56	.91		.90	1.30	
30						.64	.61		.90	.85		
31					.56	.64	.56			.80		

[a] Creek dry, as water was used above station for irrigation.

NOTE.—Creek frozen over Jan. 1 to Apr. 16 and Nov. 7 to Dec. 31; frozen solid Jan. 6. A very small flow Jan. 17.

MICHIGAN CREEK NEAR JEFFERSON, COLO.

Location.—At the highway bridge at Michigan Siding, in sec. 13, T. 8 S., R. 76 W., 2½ miles southwest of Jefferson. No tributary between the station and the mouth, 3½ miles below, and no important tributary for several miles above.

Records available.—October 17, 1910, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff.

Channel.—Somewhat shifting.

Discharge measurements.—Made from the bridge during high water and by wading at ordinary stages.

Winter flow.—Ice causes backwater during the winter months.

Diversions.—There are court decrees for diversions of 104 second-feet from Michigan Creek above the station and 40 second-feet below.

Accuracy.—Data insufficient for estimates of discharge.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of Michigan Creek near Jefferson, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 6	R. H. Fletcher	[a] 2.00	0
Apr. 22	O. M. Wimmer	1.06	25.3
July 28	do	.85	2.7
Sept. 6	Fletcher and Waha	.95	8.8
6	H. B. Waha	.95	8.0

[a] Ice.

Daily gage height, in feet, of Michigan Creek near Jefferson, Colo., for 1911.

[R. M. Truman, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1				2.7	0.8		0.85					
2		2.8							1.0			
3			2.8			.9				.95		
4											1.1	
5						1.1	1.7	.9	1.0			
6	2.0				.72				.95			
7												
8				.8			1.3	1.0				
9												.65
10										1.0		
11							.95					
12									.85			
13			2.9								.8	
14							1.0			.95		
15						1.12		1.05	1.0			
16		2.8								1.1		
17	2.7			.8								
18												
19						1.0	1.0	1.0				
20			3.0									
21											.8	
22				1.08			1.1	1.2	.9			
23						1.0		1.1		1.2		
24												
25												
26				.9			.9		.9	1.1		
27					.8						.7	
28					.85		.7					
29								1.0				
30												
31							.7			1.1		

NOTE.—Creek frozen over Jan. 1 to Mar. 31 and Nov. 13 to Dec. 31; frozen solid Jan. 6, 17, and 28.

NORTH FORK OF SOUTH PLATTE RIVER AT GRANT, COLO.

Location.—At Grant post office, in sec. 9, T. 7 S., R. 74 W., in the Pike National Forest, 250 feet above the mouth of Geneva Creek.

Records available.—July 18, 1910, to December 31, 1911.

Drainage area.—51 square miles (measured from Forest Atlas).

Gage.—Vertical staff.

Channel.—Shifting.

Discharge measurements.—Made from footbridge and by wading.

Winter flow.—Ice causes backwater during the winter months and measurements are made to determine the flow.

Diversions.—There are no court decrees for diversions from the North Fork above the station, but there is a decree for a diversion of 8 second-feet from a tributary.

Accuracy.—Though the channel is somewhat shifting, sufficient measurements were obtained to make the estimates reliable. The diurnal fluctuations at this station are so great that the mean of two daily readings does not represent the mean discharge, especially in the spring, when the creek is melting during day and freezing during night.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of North Fork of South Platte River at Grant, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar 14[a]	R. H. Fletcher	1.50	8.1	Aug. 29	R. H. Fletcher	1.45	14.2
Apr 14[a]	W. B. Freeman	1.46	13.0	Sept. 8	do	1.44	15.2
21	O. M. Wimmer	1.65	22.7	8	Waha and Fletcher	1.52	20.3
June 11	J. B. Stewart	2.15	82.8	Nov. 3[a]	G. H. Russell	1.43	3.5
July 13	W. B. Freeman	1.95	52.1				

[a] Ice conditions.

Daily gage height, in feet, of North Fork of South Platte River at Grant, Colo., for 1911.

[Edmund Couch, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1							1.80					1.70
2					1.65	2.20			1.52			1.87
3											1.52	
4								1.60				1.85
5				1.35	2.05			1.60				
6						2.20						
7		1.55							1.40	1.50		
8							1.80		1.44			1.87
9	1.65							1.50			1.45	
10		1.55				2.20		1.50	1.40			
11	1.65				2.05	2.15						1.90
12						2.15				1.40		
13							1.94					2.00
14			1.50	1.46	2.05							2.00
15				1.37					1.40			1.90
16						2.15		1.55				1.85
17								1.52		1.40	1.75	
18						2.15						
19					2.20							
20				1.45	2.20					1.35		1.30
21				1.65					1.40			1.30
22									1.40			1.35
23						2.00					1.70	
24			1.35					1.52			1.70	
25							1.82				1.90	
26				1.65	2.10		1.82					
27						1.85						
28	1.65			1.70						1.35	1.67	
29					2.05		1.65	1.45	1.40			
30					2.05	1.80						
31												

Daily discharge, in second-feet, of North Fork of South Platte River at Grant, Colo., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1....	5	23	80	35	22	14	15	16....	10	76	80	47	18	14	14
2....	5	22	88	35	21	14	16	17....	10	80	80	45	17	14	14
3....	5	22	88	35	21	14	16	18....	10	84	80	44	17	14	13
4....	5	24	88	35	21	14	17	19....	10	88	76	43	17	14	13
5....	5	66	88	35	21	14	17	20....	12	88	72	42	17	14	12
6....	5	66	88	35	19	15	18	21....	22	85	68	41	17	14	12
7....	5	66	88	35	18	15	18	22....	22	83	64	40	17	14	12
8....	5	66	88	35	17	15	17	23....	22	80	59	39	17	14	12
9....	5	66	88	38	16	15	16	24....	22	78	55	38	17	14	12
10....	5	66	88	41	16	14	15	25....	22	75	50	37	17	14	12
11....	8	66	80	44	16	14	14	26....	22	73	45	37	16	14	12
12....	8	66	80	47	16	14	14	27....	24	70	40	32	16	14	12
13....	10	66	80	51	17	14	14	28....	26	68	38	27	15	14	12
14....	13	66	80	50	17	14	14	29....	24	66	37	22	14	14	12
15....	9	72	80	48	17	14	14	30....	24	66	35	22	14	15	12
								31....	.....	73	.....	22	14	.....	12

NOTE.—Daily discharge determined as follows: Apr. 1 to 14, estimated; Apr. 15 to July 31, from a well-defined curve; Aug. 1 to 31, from a curve based on one measurement and shape of previous curves; Sept. 1 to 8, the indirect method for shifting channels; Sept. 9 to Oct. 31, from a poorly defined curve.

Monthly discharge of North Fork of South Platte River at Grant, Colo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	.....	.....	[a] 7.0	430	D.
February	.....	.....	[a] 7.0	389	D.
March	.....	.....	[a] 6.0	369	D.
April	26	5	12.7	756	B.
May	88	22	66.3	4,080	B.
June	88	35	71.7	4,270	B.
July	51	22	38.0	2,340	B.
August	22	14	17.3	1,060	B.
September	15	14	14.2	845	C.
October	18	12	14.0	861	C.
November	.....	.....	[a] 4.0	238	D.
The period	.....	.....	.....	15,600	

[a] Discharge estimated.

NORTH FORK OF SOUTH PLATTE RIVER AT CASSELLS, COLO.

Location.—At Cassells, in sec. 11, T. 7 S., R. 74 W., in the Pike National Forest. The nearest tributary is a small stream entering from the south, a short distance below.

Records available.—July 4, 1908, to December 31, 1911.

Drainage area.—128 square miles (measured from topographic sheets and Forest atlas).

Gage.—Chain gage which replaced a vertical staff reading to the same datum.

Channel.—Shifting.

Discharge measurements.—Made from bridge.

Winter flow.—Ice causes backwater during the winter months and measurements are made to determine the flow.

Diversions.—There are no court decrees for diversions between this station and that at Grant.

Accuracy.—Although the channel is shifting, sufficient measurements have been obtained to make the estimates of discharge reliable. The diurnal fluctuations due to melting during the day and freezing at night are so great at this station during the spring and, to a less extent, in the fall, that the mean of two daily gage readings does not properly represent the mean stage.

Cooperation.—Station maintained in cooperation with the United States Forest Service and the State engineer.

Discharge measurements of North Fork of South Platte River at Cassells, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 8[a]	R. H. Fletcher	2.08	21.4	June 10	J. B. Stewart	2.19	250
9[a]	do	1.84	23.2	July 12	W. B. Freeman	1.82	178
Feb. 20[a]	do	1.34	25.2	Aug. 28	R. H. Fletcher	1.33	66.7
Mar. 13[a]	do	1.16	22.1	Sept. 8	do	1.22	60.3
14[a]	do	1.16	23.5	8	Waha & Fletcher	1.22	52.6
Apr. 13	W. B. Freeman	1.20	26.1	Nov. 1	G. H. Russell	1.25	39.6
22	O. M. Wimmer	1.34	44.1				

[a] Ice conditions.

Daily gage height, in feet, of North Fork of South Platte River at Cassells, Colo., for 1911.

[Lulu Cassell, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.5	1.15	1.22	1.15	1.48	2.25	1.7	.....	1.19	1.45	1.15	2.0
2	1.6	.95	1.18	1.12	1.51	2.28	2.18	.....	1.21	1.32	1.15	2.0
3	1.5	.90	1.15	1.15	1.52	2.38	2.62	.....	1.2	1.21	1.17	1.95
4	1.9	1.1	1.2	1.15	1.55	2.1	2.45	1.43	1.19	1.2	1.12	1.8
5	1.6	1.05	1.15	1.08	1.6	2.2	2.73	1.45	1.18	1.54	1.24	1.75
6	1.8	.95	1.15	1.18	1.77	2.22	2.3	1.45	1.2	1.35	1.2	1.55
7	1.8	1.05	1.05	1.08	1.75	2.35	2.12	.....	1.2	1.25	1.45	1.6
8	1.95	1.1	1.06	1.1	1.82	2.32	2.05	.....	1.2	1.3	1.5	1.5
9	1.8	1.05	1.2	1.15	1.9	2.3	1.92	1.7	1.2	1.2	1.4	1.7
10	1.65	.95	1.1	1.1	1.9	2.2	1.88	1.7	1.2	1.19	1.25	1.65
11	2.0	.95	1.05	1.2	1.8	2.25	1.9	1.82	1.2	1.15	1.3	1.7
12	1.55	1.02	1.08	1.08	2.1	2.15	1.85	1.82	1.2	1.16	1.5	1.75
13	1.55	1.05	1.11	1.05	2.12	2.15	1.83	1.42	1.2	1.18	1.55	1.95
14	1.5	1.2	1.23	.96	2.1	2.08	1.83	1.43	1.22	1.15	1.5	1.98
15	1.6	1.1	1.06	.95	2.1	2.1	1.82	1.34	1.28	1.08	1.05	2.02
16	1.75	1.1	1.14	1.05	2.2	2.08	1.8	1.35	1.2	1.18	1.15	1.98
17	1.5	1.05	1.05	1.02	2.35	2.08	1.85	1.34	1.2	1.12	1.4	1.95
18	1.45	1.0	1.0	1.05	2.45	2.05	1.78	1.38	1.18	1.1	1.4	2.0
19	1.5	1.1	1.02	1.12	2.1	2.08	1.78	1.37	1.18	1.2	1.45	1.95
20	1.55	.90	1.08	1.35	1.8	2.11	1.69	1.38	1.19	1.15	1.5	2.08
21	1.35	.80	1.0	1.38	1.88	2.2	1.66	1.39	1.18	1.11	1.4	2.2
22	1.25	.90	1.0	1.36	1.86	2.25	1.72	1.41	1.19	1.1	1.3	1.9
23	1.28	1.1	1.04	1.45	1.9	2.1	1.65	1.4	1.2	1.2	1.7	1.7
24	1.18	.90	1.02	1.4	1.82	2.0	.....	1.37	1.18	1.18	1.8	1.2
25	1.28	1.02	1.0	1.35	1.78	1.9	.....	1.35	1.18	1.15	1.8	1.2
26	1.28	1.08	.95	1.43	1.94	1.98	.....	1.28	1.17	1.18	1.8	1.2
27	1.22	1.1	1.12	1.49	1.88	1.94	.....	.....	1.17	1.04	2.05	1.2
28	1.25	1.65	1.0	1.5	1.88	1.8	.....	1.32	1.16	1.1	2.0	1.15
29	1.3	.....	1.0	1.5	2.0	1.75	.....	1.27	1.28	1.15	2.05	1.15
30	1.22	.....	1.02	1.35	1.89	1.68	.....	1.24	1.35	1.18	2.0	1.2
31	1.15	.....	1.05	.....	2.05	.....	.....	1.22	.....	1.2	.....	1.1

NOTE.—Ice present Jan. 1 to Mar. 16 and Nov. 5 to Dec. 31.

Daily discharge, in second-feet, of North Fork of South Platte River at Cassells, Colo., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	20	22	65	271	106	97	51	89
2	20	20	70	282	255	93	53	68
3	20	22	72	324	470	89	52	53
4	20	22	77	217	380	85	51	52
5	20	17	86	252	555	89	50	107
6	20	25	122	260	325	89	52	72
7	20	17	118	311	260	107	52	58
8	20	18	134	298	230	126	52	65
9	20	22	155	290	200	145	52	52
10	20	18	155	252	190	145	52	51
11	15	27	129	271	195	178	52	40
12	17	17	217	234	180	102	52	40
13	19	15	224	234	181	84	52	40
14	30	10	217	211	181	85	55	35
15	16	10	217	217	178	71	62	30
16	22	15	252	211	172	72	52	33
17	15	13	311	211	187	71	52	27
18	12	15	356	201	167	77	50	25
19	13	20	217	211	167	76	50	35
20	17	45	129	220	142	77	51	30
21	12	49	150	252	135	78	50	26
22	12	46	145	271	150	82	51	25
23	14	60	155	217	132	80	52	35
24	13	52	134	185	129	76	50	33
25	12	45	124	155	125	72	50	30
26	10	57	167	179	121	62	48	33
27	20	66	150	167	117	65	48	20
28	12	68	150	129	113	68	47	25
29	12	68	185	118	109	61	62	30
30	13	45	152	102	105	57	72	33
31	15	.....	201	.....	101	55	.....	35

NOTE.—Daily discharge determined as follows: Mar. 1 to 10, estimated; Mar. 11 to July 1, from a fairly well defined curve; July 2 to 12, by the indirect method for shifting channels; July 13 to Oct. 10, from a fairly well defined curve; Oct. 11 to 31, by the indirect method for shifting channels.

Monthly discharge of North Fork of South Platte River at Cassells, Colo., for 1911.

[Drainage area, 128 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy[1]
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a] 24	0.188	0.22	1,480	D.
February	.....	.....	[a] 25	.195	.20	1,390	D.
March	30	10	16.8	.131	.15	1,030	C.
April	68	10	31.5	.246	.27	1,870	B.
May	356	65	162	1.27	1.46	9,960	C.
June	324	102	225	1.76	1.96	13,400	B.
July	555	101	195	1.52	1.75	12,000	C.
August	178	55	87.5	.684	.79	5,380	B.
September	72	47	52.5	.410	.46	3,120	B.
October	107	20	42.8	.334	.39	2,630	C.
November	.....	.....	[a] 25	.195	.22	1,490	D.
The period	.....	.....	.....	.....	.....	53,800	

[a] Estimated from discharge measurements.

GENEVA CREEK ABOVE JACKWHACKER CREEK, NEAR GRANT, COLO.

Location.—In Pike National Forest, 100 feet above Jackwhacker Creek and 12 miles above Grant.

Records available.—Fragmentary records August 17, 1909, to November 9, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff; datum unchanged.

Channel.—Character not determined.

Discharge measurements.—Made by wading.

Winter flow.—No data.

Diversions.—No water is diverted above the station.

Accuracy.—Data too meager for estimates of discharge.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Daily gage height, in feet, of Geneva Creek above Jackwhacker Creek, near Grant, Colo., for 1911.

[Edmund Couch, observer.]

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.
1							16						
2				0.54			17			0.55		0.50	
3						0.45	18						
4							19						
5			0.55				20						
6							21						
7					0.50		22				0.48		
8							23						
9			.54			.43	24			.55			
10							25						
11							26						
12					.50		27	0.85					
13		0.80					28						
14							29		0.07				
15				.50			30						

GENEVA CREEK AT OLD GENEVA SMELTER, NEAR GRANT, COLO.

Location.—One-fourth mile below Old Geneva smelter, in T. 6 S., R. 75 W., 10 miles above Grant.

Records available.—Fragmentary records from August 17, 1909, to September 2, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff; datum unchanged.

Channel.—Unstable, as the flow is frequently affected by backwater from beaver dams.

Discharge measurements.—Made by wading.

Winter flow.—Ice causes backwater during the winter months.

Diversions.—No water is diverted above the station, and therefore the records represent the natural run-off.

Accuracy.—Data insufficient for estimates of discharge.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

The following discharge measurement was made by W. B. Freeman:

July 13, 1911; Gage height, 1.55 feet; discharge, 36 second-feet.

Daily gage height, in feet, of Geneva Creek at Old Geneva smelter, near Grant, Colo., for 1911.

[Edmund Couch, observer.]

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1					16				
2	2.2			1.2	17			1.2	
3					18				
4					19				
5			1.2		20				
6					21				
7					22				
8					23				
9			1.2		24			1.2	
10					25				
11					26				
12					27	1.8			
13		1.55			28				
14					29		1.2		
15					30				

GENEVA CREEK AT SULLIVAN'S RANCH, NEAR GRANT, COLO.

Location.—In Pike National Forest in sec. 29, T. 6 S., R. 74 W., 4 miles above Grant, at Sullivan's ranch; 40 feet below the mouth of Threemile Creek.

Records available.—July 5, 1908, to November 3, 1911.

Drainage area.—66 square miles (measured from Forest atlas).

Gage.—Vertical staff; datum unchanged.

Channel.—Fairly permanent except during high water.

Discharge measurements.—Made by wading.

Winter flow.—Ice causes backwater during the winter months.

Diversions.—There are no court decrees for diversion of water above this station, and therefore the records probably represent the natural run-off.

Accuracy.—Conditions are favorable for good results, and the estimates of discharge should be reliable. The stream is, however, subject to sharp diurnal fluctuations, especially in the spring and, to a less extent, in the fall, caused by melting during the day and freezing at night, so that the mean gage height derived from two daily readings may not represent the true stage.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of Geneva Creek at Sullivan's ranch, near Grant, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 9[a]	Fletcher and Couch	0.50	14.6	June 11	J. B. Stewart	1.50	182
Feb. 21[a]	R. H. Fletcher	.40	15.3	July 13	W. B. Freeman	1.40	143
Mar. 14[a]	do	.48	13.7	Aug. 29	R. H. Fletcher	.80	40.6
Apr. 14	W. B. Freeman	.47	14.3	Nov. 2	G. H. Russell	.72	26.3

[a] Ice conditions.

Daily gage height, in feet, of Geneva Creek at Sullivan's ranch, near Grant, Colo., for 1911.

Mrs. M. A. Sullivan, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	.....	.....	0.50	0.70	1.70	1.25	1.00	0.75	1.00	.....
2	.....	.....	.....	.50	.68	1.60	1.80	1.00	.78	.90	0.72
3	.....	.....	.....	.50	.65	1.55	1.90	1.00	.80	.75	.80
4	.....	.....	.....	.....	.70	1.65	1.75	1.00	.85	.70	.....
5	.....	.....	.....	.45	.95	1.65	1.95	.90	.80	.90	.....
6	.....	.....	.....	.....	.95	1.60	1.90	.90	.80	.80	.....
7	.....	.....	.....	.45	1.10	1.70	1.85	.90	.75	.75	.....
8	.....	.....	.....	.45	1.20	1.70	1.70	.90	.75	.75	.....
9	0.50	.....	.....	.45	1.35	1.68	1.55	.90	.75	.80	.....
10	.....	.....	.....	.50	1.10	1.68	1.45	.90	.75	.70	.....
11	.....	.....	.....	.50	.95	1.62	1.45	1.00	.75	.70	.....
12	.....	.....	.....	.....	1.08	1.65	1.40	1.00	.72	.70	.....
13	.....	.....	.....	.50	1.20	1.55	1.35	.90	.70	.70	.....
14	.....	.....	0.48	.50	1.25	1.60	1.30	.88	.75	.70	.....
15	.....	.....	.....	.65	1.25	1.55	1.30	.85	.80	.70	.....
16	.....	.....	.....	.58	1.35	1.55	1.30	.90	.70	.70	.....
17	.....	.....	.....	.50	1.40	1.55	1.40	.88	.70	.70	.....
18	.....	.....	.....	.50	1.55	1.58	1.30	.90	.70	.70	.....
19	.....	.....	.....	.62	1.45	1.55	1.30	.90	.70	.....	.....
20	.....	.....	.....	.64	1.30	1.55	1.30	.88	.75	.....	.....
21	.....	0.40	.....	.70	1.28	1.65	1.20	.90	.75	.....	.....
22	.....	.....	.40	.68	1.25	1.78	1.28	.95	.72	.....	.....
23	.....	.....	.40	.70	1.28	1.72	1.20	1.00	.70	.....	.....
24	.....	.....	.....	.60	1.35	1.60	1.20	.90	.70	.....	.....
25	.....	.....	.40	.65	1.35	1.50	1.15	.90	.70	.....	.....
26	.....	.....	.40	.68	1.38	1.45	1.15	.80	.70	.....	.....
27	.....	.....	.....	.80	1.45	1.45	1.10	.80	.70	.....	.....
28	.....	.....	.....	.80	1.40	1.40	1.15	.80	.70	.....	.....
29	.....	.....	.40	.82	1.50	1.30	1.10	.80	.80	.75	.....
30	.....	.....	.....	.75	1.45	1.30	1.05	.78	.85	.75	.....
31	.....	.....	.45	.....	1.50	.....	1.00	.75	.....	.75	.....

NOTE.—Ice present Jan. 1 to about Mar. 21.

Daily discharge, in second-feet, of Geneva Creek at Sullivan's ranch, near Grant, Colo., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	15	33	226	117	66	32	66	30
2	.....	15	31	202	239	66	36	51	29
3	.....	15	28	190	263	66	38	32	38
4	.....	14	33	214	227	66	44	27	.....
5	.....	12	67	214	276	51	38	51	.....
6	.....	12	67	202	263	51	38	38	.....
7	.....	12	94	226	251	51	32	32	.....
8	.....	12	114	226	216	51	32	32	.....
9	.....	12	145	221	182	51	32	38	.....
10	.....	15	94	221	159	51	32	27	.....
11	.....	15	67	207	159	66	32	27	.....
12	.....	15	90	214	148	66	29	27	.....
13	.....	15	114	190	137	51	27	27	.....
14	14	15	124	202	122	48	32	27	.....
15	.....	28	124	190	122	44	38	27	.....
16	.....	21	145	190	122	51	27	27	.....
17	.....	15	156	187	113	48	27	27	.....
18	.....	15	190	193	122	51	27	27	.....
19	.....	25	167	187	122	51	27	28	.....
20	.....	27	134	187	122	48	32	28	.....
21	.....	33	130	210	102	51	32	28	.....
22	8.0	31	124	232	118	58	29	29	.....
23	8.0	33	130	226	102	66	27	29	.....
24	8.0	23	145	198	102	51	27	29	.....
25	8.0	28	145	176	92	51	27	30	.....
26	8.0	31	152	164	92	38	27	30	.....
27	8.0	45	167	164	83	38	27	31	.....
28	8.0	45	156	153	92	38	27	31	.....
29	8.0	48	178	126	83	38	38	32	.....
30	10	39	167	126	74	36	44	32	.....
31	12	.....	178	.....	66	32	.....	32	.....

NOTE.—Daily discharge determined as follows: Mar. 22 to June 11 and July 14 to Nov. 3, from two fairly well-defined curves; June 12 to July 13, by indirect method for shifting channels; discharge interpolated Oct. 19 to 28.

Monthly discharge of Geneva Creek at Sullivan's ranch, near Grant, Colo., for 1911.

[Drainage area, 66 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
January			[a] 15	0.227	0.26	922
February			[a] 15	.227	.24	833
March			11.7	.177	.20	719
April	48	12	22.7	.344	.38	1,350
May	190	28	119	1.80	2.08	7,320
June	232	126	195	2.95	3.29	11,600
July	276	66	146	2.21	2.55	8,980
August	66	32	51.3	.777	.90	3,150
September	44	27	31.9	.483	.54	1,900
October	66	27	32.2	.488	.56	1,980
November			[a] 20	.303	.34	1,190
December						
The period						39,900

[a] Estimated.

NOTE.—Discharge estimated at 14 second-feet Mar. 1–13 and 11 second-feet Mar. 15–21.

GENEVA CREEK AT GRANT, COLO.

Location.—In the Pike National Forest, at highway bridge in sec. 9, T. 7 S., R. 74 W., at Grant post office; 300 feet above mouth of creek.

Records available.—November 3 to December 31, 1911.

Drainage area.—74 square miles (measured from Forest Atlas).

Gage.—Vertical staff.

Channel.—Somewhat shifting during high water.

Discharge measurements.—Made from bridge during high water and by wading at ordinary stages.

Winter flow.—Ice causes backwater during the winter months.

Diversions.—There are no court decrees for diversions above this station.

Accuracy.—Data insufficient for estimates of discharge.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

The following discharge measurement was made by G. H. Russell:
November 3, 1911: Gage height, 0.96 foot; discharge, 12 second-feet.

Daily gage height, in feet, of Geneva Creek at Grant, Colo., for 1911.

[Edmund Couch, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1			11		1.60	21		1.70
2			12			22		1.70
3	0.96		13		1.75	23		
4		1.45	14		1.70	24		
5			15		1.65	25		
6			16		1.65	26		
7			17	1.25		27		
8		1.45	18			28		
9			19			29		
10			20		1.70	30		
						31		

NOTE.—Ice present Nov. 16 to Dec. 31; ice 10 inches thick Dec. 11 and 14 inches thick Dec. 20, 21, and 22.

SMELTER CREEK NEAR GRANT, COLO.

Location.—In Pike National Forest, at Old Geneva smelter, in T. 6 S., R. 75 W., 10 miles above Grant; one-fourth mile above the mouth of creek.

Records available.—Fragmentary records August 17, 1909, to November 9, 1911.

Drainage area.—Not measured.

Gage.—Vertical staff whose datum has remained unchanged.

Channel.—Data too meager to determine.

Discharge measurements.—Made by wading.

Winter flow.—Ice causes backwater during the winter months, and the records are discontinued.

Diversions.—There are no court decrees for diversions above this station and therefore the records probably represent the natural run-off.

Accuracy.—Data insufficient for estimates of discharge.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of Smelter Creek near Grant, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
July 13	W. B. Freeman	0.90	12.7
Nov. 2	G. H. Russell	.52	1.4

Daily gage height, in feet, of Smelter Creek near Grant, Colo., for 1911.

[Edmund Couch, observer.]

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.
1							16						
2	1.05			0.62			17			0.60		1.54	
3						0.50	18						
4							19						
5			0.65				20						
6							21						
7					1.54		22				0.50		
8							23						
9			.63			.45	24			.60			
10							25						
11							26						
12					1.55		27	0.95					
13		0.90					28						
14							29						
15				.55			30		0.07				
							31						

DUCK LAKE CREEK NEAR GRANT, COLO.

Location.—At Gordon's ranch, in sec. 12, T. 6 S., R. 75 W., 50 yards above the mouth, 7 miles above Grant, in Pike National Forest.

Records available.—Fragmentary records August 17, 1909, to November 9, 1911.

Drainage area.—8 square miles (measured from topographic sheet).

Gage.—Vertical staff; datum unchanged.

Channel.—Data too meager to determine.

Discharge measurements.—Made from footbridge or by wading.

Winter flow.—Ice causes backwater during the winter months and the records are discontinued.

Diversions.—There are no court decrees for diversions above this station and therefore the records probably represent the natural run-off.

Accuracy.—Data insufficient for estimates of discharge.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

The following discharge measurement was made by G. H. Russell:
November 2, 1911: Gage height, 0.88 foot; discharge, 1.3 second-feet.

Daily gage height, in feet, of Duck Lake Creek near Grant, Colo., for 1911.

[Edmund Couch, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1								16							
2		1.55			0.95			17				0.95		0.87	
3							0.95	18							
4								19	1.40						
5				1.00				20							
6								21							
7						0.82		22					0.80		
8								23		1.45					
9				.95			.87	24				.95			
10		1.55		.95				25							
11	0.95							26							
12						.90		27		1.30					
13			1.30					28							
14								29			1.05				
15					.80			30							
								31							

SCOTT GOMER CREEK[1] NEAR GRANT, COLO.

Location.—Near Sullivan's ranch, in sec. 19, T. 6 S., R. 74 W., in the Pike National Forest, about 5 miles above Grant, one-fourth mile above mouth of creek. No tributary enters between mouth and station.

Records available.—Fragmentary records August 16, 1909, to December 31, 1911.

Drainage area.—21 square miles (measured from topographic sheet).

Gage.—Vertical staff, moved to its present location, 2¾ miles below original site, September 4, 1909. Datum unchanged in new location, but has no determined relation to datum of original gage.

Channel.—Slightly shifting.

Discharge measurements.—Made by wading.

Winter flow.—Ice causes backwater during the winter months.

Diversions.—There are no court decrees for diversions above this station, and therefore the records probably represent the natural run-off.

Accuracy.—Conditions are favorable for fairly accurate results and the estimates of flow should be reliable.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of Scott Gomer Creek near Grant, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 9[a]	Fletcher and Couch	1.10	4.7	June 11	J. B. Stewart	2.45	31.4
Feb. 21[a]	R. H. Fletcher	.90	4.8	July 13	W. B. Freeman	2.53	40.7
Mar. 14[a]	do	1.10	5.9	Aug. 29	R. H. Fletcher	1.68	12.9
Apr. 14[a]	W. B. Freeman	1.26	3.2	Nov. 2	G. H. Russell	1.60	9.6
21	O. M. Wimmer	1.20	7.3				

[a] Ice conditions.

[1] Also called East Geneva Creek.

Daily gage height, in feet, of Scott Gomer Creek near Grant, Colo., for 1911.

[Edmund Couch, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1												
2					1.30	3.15			1.65		1.60	1.30
3											1.65	
4				0.95								1.30
5								1.80				
6												
7		0.70							1.65	1.65		
8							2.80					
9	0.70							1.67			1.55	
10		.70				3.55		1.67				
11					2.60	2.45						1.30
12										1.65		
13							2.54					
14	.75		1.10	1.26								
15				1.00					1.65			
16						2.55		1.70				
17								1.70		1.60	1.40	
18												
19					3.00							
20				1.10								1.35
21		.90		1.20								
22									1.60			
23						2.95						
24			1.00					1.77				
25											1.35	
26					3.00							
27						2.85						
28				1.30								
29							1.95	1.68				
30												
31												

NOTE.—Ice caused backwater Jan. 1 to Apr. 14 and Nov. 17 to Dec. 31.

Daily discharge, in second-feet, of Scott Gomer Creek near Grant, Colo., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		7.5	70	53	16	11	11	10
2		7.5	72	53	16	11	11	10
3		11	75	52	15	11	11	11
4		14	78	52	14	11	11	11
5		17	81	52	14	11	11	11
6		21	84	51	13	11	11	10
7		25	88	51	12	11	11	10
8		29	92	51	11	11	11	10
9		33	96	48	11	11	11	10
10		37	100	45	11	11	11	
11		41	34	42	11	11	11	
12		43	35	40	11	11	11	
13		46	36	38	12	11	11	
14		49	37	36	12	11	11	
15	5	52	38	34	12	11	10	
16	5	55	38	32	12	11	10	
17	5	58	41	30	12	11	10	
18	5.5	61	44	29	12	11	10	
19	5.5	63	47	28	12	10	10	
20	5.5	63	50	27	12	10	10	
21	6.5	63	53	26	13	10	10	
22	6.5	63	56	25	13	10	10	
23	6.5	63	60	24	13	10	10	
24	7.0	63	58	23	13	10	10	
25	7.0	63	56	22	12	10	10	
27	7.5	63	55	21	12	10	10	
26	7.5	64	54	20	11	10	10	
28	7.5	65	54	19	11	10	10	
29	7.5	66	54	18	11	10	10	
30	7.5	67	53	18	11	11	10	
31		68		17	11		10	

NOTE.—Daily discharge determined from a rating curve that is fairly well defined between 5 and 36 second-feet. Discharge interpolated for days for which gage heights are missing.

Monthly discharge of Scott Gomer Creek near Grant, Colo., for 1911.

[Drainage area, 21 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	[a] 5.0	0.238	0.27	307	
February	.....	.....	[a] 5.0	.238	.25	278	
March	.....	.....	[a] 5.0	.238	.27	307	
April	7.5	.....	5.75	.274	.31	342	C.
May	68	7.5	46.5	2.21	2.55	2,860	C.
June	100	34	59.6	2.84	3.17	3,550	C.
July	53	17	34.7	1.65	1.90	2,130	C.
August	16	11	12.3	.586	.68	756	C.
September	11	10	10.6	.505	.56	631	C.
October	11	10	10.5	.500	.58	646	C.
November	11	.....	8.0	.381	.43	476	C.
December	.....	.....	[a] 5.0	.238	.27	307	
The year	100	.....	17.4	.829	11.24	12,600	

[a] Estimated.

NOTE.—Discharge Apr. 1 to 14 estimated at 5 second-feet per day. Nov. 10 to 30 at 7 second-feet.

CLEAR CREEK AT IDAHO SPRINGS, COLO.

Location.—At Idaho Springs, in sec. 36, T. 3 S., R. 73 W., half a mile below mouth of Chicago Creek and a quarter of a mile above entrance of Soda Creek and Virginia Canyon.

Records available.—October 8, 1910, to December 31, 1911.

Drainage area.—239 square miles (measured from Forest Atlas).

Gage.—A staff gage placed March 23, 1911, a short distance upstream from the original staff gage, which was used until that date. The new gage was referred to a datum 0.2 foot lower than the original. All readings have been referred to the latter gage.

Channel.—Slightly shifting.

Discharge measurements.—Made by wading.

Winter flow.—Ice causes backwater during the winter months.

Diversions.—There are no court decrees for diversions above the station, but the records do not represent the natural flow at all times, as water is diverted from Fraser River, in the Grand Basin, into Clear Creek by means of a tunnel and canal entering the West Fork. This diversion has a court decree for 53 second-feet.

Accuracy.—Conditions are favorable for fairly accurate results.

Artificial control.—The operation of two power plants some 12 miles above the station causes a daily fluctuation of 0.10 foot or more at the gage during the low-water period.

Cooperation.—Station maintained in cooperation with the United States Forest Service.

Discharge measurements of Clear Creek at Idaho Springs, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 23	Fletcher and Miles	0.50	34.5	Sept. 22	G. A. Gray	0.98	119
Apr. 27	O. M. Wimmer	.82	74.8	Nov. 8[a]	G. H. Russell	.80	63.4
June 29	E. O. Christiansen	2.70	508	Dec. 21[b]	R. H. Fletcher	.80	49.6
Aug. 12	R. H. Fletcher	1.60	241				

[a] Slight ice effect. [b] Ice conditions.

Daily gage height, in feet, of Clear Creek at Idaho Springs, Colo., for 1911.

[W. B. Kelso, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		0.55			0.7	2.15	2.15					0.8
2						2.3		1.35		0.7	0.75	
3						2.3		1.3				
4							2.65				.7	.6
5				0.6		2.5	3.3	1.2	0.95	.9	.65	
6					1.1	2.5	3.35			.9		
7						2.7	3.15			1.0		
8			0.8		1.3	2.8	3.0	1.1			.8	.6
9					1.3	3.0		1.1				
10					1.4	2.75	2.5			.8	.6	
11		.55							.75	.85	.7	
12		.55			1.7	2.9						
13					1.3	2.95		1.1	.8		.7	
14							2.3	1.1		.7		
15				.7	1.3	2.8	2.2	1.05				
16					1.4			1.1	.7	.6		.6
17					1.45	2.6		1.1	.55	.6	1.1	
18					1.6						1.1	.55
19	0.55					2.6	2.15	1.0	.8			.75
20			.55	.6	1.5							
21		.7					1.9	1.2				.8
22					1.4				1.0		.6	
23	.55		.5			2.8			.6	.65	.5	
24			.6		1.5	2.7	1.75	1.1				
25							1.7		.6	.65		
26				.75								
27				.8		2.3						
28						2.2		1.0	.55			
29					1.8	2.3	1.5					
30	.6		.55		1.9			.95	.65			1.0
31					2.0			.95				

NOTE.—Gage heights during January, February, and to Mar. 8 distorted by ice; ice from Nov. 17 to Dec. 31.

Daily discharge, in second-feet, of Clear Creek at Idaho Springs, Colo., for 1911.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1			61	372	372				
2				410		182		61	69
3				410		171			
4					498				61
5		46		466	665	151	703	94	54
6			131	460	680			94	
7				510	622			112	
8			171	535	585	131			77
9			171	585		131			
10			192	522	460			77	46
11							69	86	61
12			260	560					
13			171	572		131	77		61
14					410	131		61	
15		61	171	535	385	122			
16			192			131	61	46	
17			202	485		131	40	46	
18			235						
19				485	372	112	77		
20	40	46	213						
21					310	151			
22			192				112		
23	33			535			46	54	
24	46		213	510	272	131			
25					260		46	54	
26		69							
27		77		410					
28				385		112	40		
29			285	410	213				
30	40		310			103	54		
31			335			103			

CLEAR CREEK AT FORKSCREEK, COLO.

Location.—At Forkscreek, a few hundred feet below the mouth of North Clear Creek.

Records available.—May 29, 1899, to December 31, 1911.

Drainage area.—345 square miles.

Gage.—A chain gage was installed June 3, 1907, 50 feet upstream from first site. The original gage had been moved 30 feet upstream on July 19, 1905, but set to read the same as before. The chain gage was also referred to the same datum.

Channel.—Very shifting.

Discharge measurements.—Made from footbridge and by wading.

Winter flow.—Ice causes backwater during the winter months and measurements are made to determine the flow.

Diversions.—There are no court decrees for diversions between Idaho Springs and Forkscreek. Below there are decrees for diversions of 1,668 second-feet from Clear Creek.

Artificial control.—The natural flow is regulated to some extent by storage in various ponds and reservoirs above.

Accuracy.—Estimates have been made by the indirect method for shifting channels and can be considered in general only fair although the 1911 estimates have been rated as good.

Cooperation.—Station maintained in cooperation with the State engineer.

Discharge measurements of Clear Creek at Forkscreek, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 3[a]	Miles and Fletcher	7.37	22.6	June 29	E. O. Christiansen	7.00	537
Mar. 1[a]	R. H. Fletcher	6.73	24.4	Aug. 12	R. H. Fletcher	6.10	274
1[a]	do	7.33	28.4	Sept. 23	G. A. Gray	5.62	86.2
24	do	5.98	41.2	Nov. 8	G. H. Russell	5.80	81.3
24	Miles and Fletcher	5.94	32.1	Dec. 22	R. H. Fletcher	[b] 7.40	40.7
May 13	J. B. Stewart	6.70	286				

[a] Ice conditions. [b] Gage height distorted by ice. Reading to top of ice.

Daily gage height, in feet, of Clear Creek at Forkscreek, Colo., for 1911.

[C. W. Haisington, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	6.2	7.8	6.15	6.25	7.3	6.8	6.2	5.7	5.75	5.7	5.65
2	.....	6.15	7.75	6.1	6.2	7.4	7.45	6.1	5.7	5.6	5.7	5.65
3	.....	6.1	7.75	6.05	6.2	7.55	7.65	6.1	5.95	5.6	5.7	5.3
4	7.85	6.15	7.6	6.05	6.3	7.65	7.65	6.0	5.85	5.6	5.7	5.3
5	7.8	6.15	7.5	6.15	6.3	7.55	7.6	6.0	5.7	5.6	5.65	5.4
6	7.55	6.2	7.45	6.1	6.45	7.55	7.7	5.9	5.7	5.6	5.7	5.55
7	7.55	6.2	7.3	6.05	6.7	7.45	7.45	5.9	5.65	5.6	5.7	5.7
8	7.65	6.05	7.3	6.0	6.7	7.45	7.25	5.85	5.65	5.65	5.8	5.75
9	7.6	6.0	6.9	6.1	6.8	7.4	7.15	5.85	5.65	5.65	5.8	5.95
10	7.4	6.3	6.9	6.05	6.9	7.4	7.0	6.0	5.6	5.6	5.8	5.95
11	7.5	6.35	6.3	6.1	6.75	7.3	6.9	6.1	5.6	5.65	5.6	5.95
12	7.3	6.45	6.25	6.1	6.6	7.45	6.9	6.1	5.6	5.65	5.5	6.4
13	7.55	6.35	6.25	6.1	6.7	7.5	6.85	6.1	5.6	5.7	5.65	6.5
14	6.95	6.35	5.9	6.0	6.7	7.5	6.7	6.1	5.6	5.7	5.65	6.6
15	6.45	6.25	5.8	5.9	6.8	7.45	6.7	6.0	5.6	5.7	5.7	6.7
16	6.35	6.25	5.8	6.0	6.8	7.35	6.6	6.0	5.6	5.5	5.6	6.7
17	6.4	6.25	5.8	6.0	6.9	7.2	6.55	6.0	5.6	5.6	5.7	6.85
18	6.35	6.45	5.85	6.05	6.9	7.1	6.55	6.0	5.6	5.6	5.6	6.9
19	6.35	6.4	5.95	6.1	7.0	7.15	6.55	5.95	5.6	5.65	5.6	6.9
20	6.25	6.8	6.0	6.1	6.85	7.3	6.55	5.9	5.6	5.7	5.7	7.0
21	6.35	6.85	5.85	6.1	6.8	7.55	6.5	5.9	5.6	5.7	5.7	7.1
22	6.55	6.85	6.15	6.2	6.7	7.6	6.5	5.9	5.6	5.65	5.7	7.1
23	6.85	7.1	6.05	6.2	6.6	7.4	6.5	5.9	5.6	5.65	5.7	7.1
24	6.6	7.1	6.0	6.2	6.7	7.3	6.5	5.85	5.6	5.65	5.65	7.0
25	6.4	7.25	6.05	6.2	6.8	7.2	6.45	5.85	5.6	5.65	5.55	7.0
26	6.25	7.7	5.9	6.3	6.9	7.1	6.4	5.8	5.6	5.7	5.65	7.1
27	6.2	7.85	5.8	6.35	6.9	7.0	6.4	5.8	5.6	5.7	5.7	7.2
28	6.15	7.85	6.05	6.4	7.0	7.0	6.4	5.8	5.6	5.7	5.7	7.2
29	6.1	.....	6.1	6.5	7.05	6.9	6.3	5.75	5.6	5.7	5.65	7.1
30	6.05	.....	6.15	6.3	7.1	6.85	6.3	5.75	5.6	5.6	5.65	7.1
31	6.15	.....	6.15	.....	7.1	.....	6.2	5.7	.....	5.7	.....	.....

NOTE.—Ice present Jan. 1 to Mar. 13 and Dec. 7 to 31.

Daily discharge, in second-feet, of Clear Creek at Forkscreek, Colo., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	23	24	26	83	110	670	432	255	128	103	67	55
2	23	24	26	70	96	738	833	216	128	76	67	55
3	23	24	26	58	96	825	965	220	215	76	67	27
4	23	24	26	58	125	882	970	185	177	76	67	27
5	23	24	26	83	125	835	945	181	160	73	57	33
6	23	24	26	70	179	837	1,010	155	160	73	65	45
7	23	24	26	58	286	780	860	158	112	73	65	45
8	23	24	26	47	286	782	740	143	112	80	81	45
9	23	24	28	70	332	750	680	146	112	80	81	45
10	23	24	28	58	386	752	595	202	97	68	81	45
11	23	24	28	70	309	690	540	242	97	78	50	45
12	23	24	28	70	240	784	545	245	96	78	40	45
13	23	24	28	70	286	814	515	248	95	84	55	45
14	23	24	30	47	286	820	435	252	94	84	55	41
15	23	25	18	30	338	790	442	217	93	84	63	41
16	23	25	18	47	340	730	390	219	92	58	50	41
17	23	25	18	47	397	640	365	221	91	64	63	41
18	23	25	24	58	400	580	373	223	90	64	50	41
19	23	25	38	70	460	610	375	205	88	69	50	41
20	23	25	47	70	375	708	378	188	87	80	63	41
21	23	25	24	70	355	865	357	191	85	80	63	41
22	23	25	83	96	305	900	363	193	83	79	63	41
23	23	25	58	96	260	770	367	195	80	67	63	41
24	23	25	47	96	305	712	370	175	80	67	55	41
25	23	25	58	96	360	652	350	175	79	67	45	41
26	23	25	30	125	420	590	327	160	78	70	55	41
27	23	25	18	138	422	533	330	160	78	70	63	35
28	23	25	58	160	480	535	333	160	78	69	63	35
29	23	.....	70	198	510	480	290	143	77	69	55	35
30	23	.....	83	125	545	455	292	143	77	52	55	35
31	23	.....	83	.....	545	.....	252	127	.....	67	.....	35

NOTE.—Daily discharge estimated, because of ice, Jan. 1 to Mar. 13 and Dec. 7 to 31; discharge Mar. 14 to May 13 determined from a rating curve fairly well defined between 30 and 450 second-feet; discharge May 14 to Dec. 6 computed by indirect method for shifting channels.

Monthly discharge of Clear Creek at Forkscreek, Colo., for 1911.

[Drainage area, 345 square miles.]

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	23	23	23	1,410	B.
February	25	24	24.4	1,360	B.
March	83	18	37.2	2,290	B.
April	198	30	81.1	4,830	A.
May	545	96	321	19,800	B.
June	900	455	717	42,700	B.
July	1,010	252	517	31,800	B.
August	255	127	192	11,800	B.
September	215	77	104	6,170	B.
October	103	52	73.5	4,520	B.
November	81	40	60.6	3,600	B.
December	55	27	40.8	2,510	B.
The year	1,010	18	183	133,000	

ST. VRAIN CREEK AT LYONS, COLO.

Location.—Three-fourths of a mile below Lyons, in sec. 17, T. 3 N., R. 70 W., one fourth mile below the junction of North and South St. Vrain creeks and just below Stone Canyon.

Records available.—August 1, 1887, to October 31, 1890; June 13, 1895, to October 31, 1903; July 1, 1904, to December 31, 1911.

Drainage area.—209 square miles.

Gage.—Inclined staff gage installed August 9, 1909, at practically the same datum as the inclined staff gage used from 1895 to 1903. It is not known whether the gage used prior to 1895 was located at the present site.

Channel.—Character not known, as only computed records are received.

Discharge measurements.—Made from car and cable.

Winter flow.—Ice causes backwater during a portion of the winter months.

Diversions.—There are court decrees for the diversion of 166 second-feet from the St. Vrain and tributaries above the station. Below there are court decrees for 1,632 second-feet from St. Vrain Creek and flood-water diversions of 190,000 acre-feet.

Cooperation.—From 1887 to 1890 and from July 1, 1904, to 1911 the station was maintained by the State engineer, by whom the records have been furnished.

Discharge measurements of St. Vrain Creek at Lyons, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 9	C. E. Turner	1.45	1.5	July 31	C. C. Hezmalhalch	2.70	151
Mar. 9	do	1.93	24.1	Aug. 21	do	2.43	82.4
Apr. 12	do	1.98	28.6	Sept. 14	Grieve and Hezmalhalch	2.34	70.0
28	do	2.28	67.6				
May 18	do	3.12	249	Oct. 16	C. E. Turner	2.15	43.6
26	Thos. Grieve	3.15	247	Dec. 15	do	1.77	10.2

Daily gage height, in feet, of St. Vrain Creek at Lyons, Colo., for 1911.

[Lloyd Hess, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.7	1.85	1.7	2.0	2.4	3.5	3.3	2.6	2.3	2.4	1.95	1.85
2	.....	1.8	1.85	2.05	2.45	3.5	3.5	2.6	2.3	2.4	1.95	1.85
3	.....	1.8	1.8	2.1	2.55	3.5	3.6	2.8	2.6	2.2	2.0	1.9
4	.....	1.7	1.8	2.05	2.5	3.55	3.6	2.7	2.6	2.2	2.0	1.85
5	1.8	.....	1.85	2.1	2.5	3.6	3.45	2.7	2.5	2.2	2.0	1.9
6	1.8	.....	1.9	2.05	2.8	3.6	3.4	2.7	2.5	2.45	2.0	1.8
7	1.8	.....	1.9	2.0	2.85	3.6	3.45	2.7	2.5	2.45	2.0	1.75
8	1.8	.....	1.85	2.0	3.0	3.7	3.4	2.45	2.45	2.45	2.0	1.7
9	1.8	.....	1.9	2.0	3.0	4.0	3.3	2.4	2.3	2.4	2.0	1.65
10	1.8	1.0	1.9	2.1	2.95	3.7	3.1	2.45	2.2	2.3	1.95	1.7
11	1.85	1.8	1.9	2.05	2.85	3.65	3.05	2.5	2.15	2.2	1.75	1.65
12	1.85	1.75	1.85	2.0	2.85	3.7	3.1	2.55	2.25	2.2	1.80	1.65
13	1.85	1.7	1.9	1.95	3.0	3.8	3.05	2.45	2.25	2.2	2.0	1.7
14	1.8	1.7	1.8	1.95	3.0	3.7	3.05	2.45	2.3	2.1	2.0	1.65
15	1.8	1.7	1.9	1.85	3.1	3.8	3.1	2.4	2.35	2.1	2.0	1.7
16	1.75	1.7	1.9	2.05	3.1	3.9	3.05	2.5	2.3	2.1	2.0	1.65
17	1.7	1.75	1.8	2.1	3.1	3.8	3.0	2.4	2.25	2.1	1.70	1.6
18	1.7	1.6	1.85	2.0	3.05	3.5	3.05	2.45	2.2	2.1	1.80	1.6
19	1.7	1.6	1.9	2.05	3.2	3.55	3.1	2.5	2.15	2.1	1.95	1.6
20	1.7	1.6	1.9	2.1	3.1	3.6	3.1	2.45	2.0	2.1	2.0	1.6
21	1.7	1.65	1.9	2.1	3.0	3.8	3.05	2.45	2.0	2.1	1.7	0.0
22	1.75	1.6	2.0	2.2	2.9	4.0	3.05	2.45	2.1	2.1	1.7	0.0
23	1.85	1.75	1.9	2.3	2.9	3.8	3.1	2.6	2.1	2.2	1.6	1.6
24	1.8	1.75	1.9	2.25	3.0	3.6	3.0	2.65	2.1	2.1	.0	1.6
25	1.75	1.8	1.9	2.3	3.05	3.5	2.9	2.6	2.1	2.05	1.7	1.6
26	1.75	1.8	1.85	2.15	3.2	3.45	2.85	2.5	2.05	2.0	1.75	1.6
27	1.7	1.8	1.85	2.1	3.2	3.4	2.9	2.4	2.1	2.0	1.8	1.6
28	1.75	1.7	2.0	2.25	3.15	3.4	2.85	2.4	2.1	1.95	1.8	0.0
29	1.8	.....	1.9	2.5	3.15	3.4	2.8	2.35	2.25	2.0	1.75	1.6
30	1.9	.....	2.0	2.55	3.25	3.35	2.8	2.35	.....	2.0	1.85	1.6
31	1.9	.....	2.0	.....	3.50	.....	2.7	2.4	.....	2.0	.....	0.0

Daily discharge, in second-feet, of St. Vrain Creek at Lyons, Colo., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	8	16	8	28	82	372	302	118	66	82	24	16
2	5	13	16	33	90	372	372	118	66	82	24	16
3	5	13	13	38	108	372	410	160	118	52	28	19
4	5	8	13	33	98	391	410	138	118	52	28	16
5	13	2	16	38	98	410	354	138	98	52	28	19
6	13	2	19	33	160	410	336	138	98	90	28	13
7	13	2	19	28	172	410	354	138	98	90	28	10
8	13	2	16	28	210	450	336	90	90	90	28	8
9	13	4	19	28	210	576	302	82	66	82	28	6
10	13	6	19	38	197	450	238	90	52	66	24	8
11	16	13	19	33	172	430	224	98	45	52	10	6
12	16	10	16	28	172	450	238	108	59	52	13	6
13	16	8	19	24	210	490	224	90	59	52	28	8
14	13	8	13	24	210	450	224	90	66	38	28	6
15	13	8	19	16	238	490	238	82	74	38	28	8
16	10	8	19	33	238	532	224	98	66	38	28	6
17	8	10	13	38	238	490	210	82	59	38	8	5
18	8	5	16	28	224	372	224	90	52	38	13	5
19	8	5	19	33	268	391	238	98	45	38	24	5
20	8	5	19	38	238	410	238	90	28	38	28	5
21	8	6	19	38	210	490	224	90	28	38	8	3
22	10	5	28	52	184	576	224	90	38	38	8	3
23	16	10	19	66	184	490	238	118	38	52	5	5
24	13	10	19	59	210	410	210	128	38	38	3	5
25	10	13	19	66	224	372	184	118	38	33	8	5
26	10	13	16	45	268	354	172	98	33	28	10	5
27	8	13	16	38	268	336	184	82	38	28	13	5
28	10	8	28	59	253	336	172	82	38	24	13	3
29	13	.....	19	98	253	336	160	74	59	28	10	5
30	19	.....	28	108	285	319	160	74	70	28	16	5
31	19	.....	28	.....	372	.....	138	82	.....	28	.....	3

NOTE.—Daily discharge interpolated for days for which gage heights are missing.

Monthly discharge of St. Vrain Creek at Lyons, Colo., for 1911.

[Drainage area, 209 square miles.]

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	19	5	11	700
February	16	2	8.1	448
March	28	8	18	1,130
April	108	16	42	2,480
May	372	82	205	12,600
June	576	319	425	25,300
July	410	138	250	15,400
August	160	74	102	6,290
September	118	33	61	3,650
October	90	24	49	3,020
November	28	3	19	1,130
December	19	3	7.7	472
The year	576	2	100	72,600

BOULDER CREEK AT ORODELL, COLO.

Location.—At Orodell station in sec. 27, T. 1 N., R. 71 W.; just below mouth of Fourmile Creek.

Records available.—March 18, 1907, to November 30, 1911. From May 14, 1895, to December 20, 1909, a station was maintained about 1 mile below the present site, chiefly by the State engineer. The records at the two points are not directly comparable, as some water is diverted for irrigation between. From 1902 to 1906 the records for the lower station were published only in the reports of the State engineer.

Drainage area.—108 square miles (State engineer's report).

Gage.—Automatic recording gage installed by the Central Colorado Power Co.

Channel.—Not known, as only the computed records are furnished.

Discharge measurements.—Made from car and cable.

Winter flow.—Ice causes backwater during the winter months and during that period discharge measurements are made to determine the flow.

Diversions.—There are no diversions from Boulder Creek above the station but there are court decrees for diversions of 165 second-feet from tributaries entering above. Below the station there are decrees for diversions of 2,871 second-feet from Boulder Creek.

Cooperation.—Station maintained by the State engineer in cooperation with the Central Colorado Power Co., by which the records are furnished.

Discharge measurements of Boulder Creek at Orodell, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 14[a]	C. L. Chatfield	[b] 2.50	2.4	June 1	Thos. Grieve	3.05	220
Feb. 10[a]	C. E. Turner	1.66	5.6	9	C. C. Hezmalhalch	3.42	444
Mar. 5	Chatfield and Turner	[b] 2.48	2.6	Aug. 1	do	2.48	83
10	C. E. Turner	[b] 2.66	6.0	22	do	2.20	54
Apr. 13	do	[b] 2.49	2.7	Sept. 15	Hezmalhalch and Grieve	1.90	26
26	do	1.93	32.0	Oct. 17	C. E. Turner	1.68	14.4
May 18	do	3.00	200	Dec. 16	do	1.92	12.2

[a] Ice conditions. [b] Gage heights to temporary gage datum.

Daily gage heights, in feet, of Boulder Creek at Orodell, Colo., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		2.71		1.40	2.37	3.08	2.82	2.28	2.15		1.65
2		2.65		1.45	2.46	3.15	2.95	2.45	2.10		1.65
3		2.67		1.50	2.42	3.25	3.15	2.40	2.10		1.65
4		2.70		1.60	2.28	3.05	3.20	2.36	2.05		1.7
5		2.65	1.35	1.50	2.32	3.20	3.25	2.28	2.05		1.7
6		2.60	1.35	1.80	2.45	3.20	3.20	2.18	2.05		1.7
7		2.50	1.35	1.45	2.63	3.28	3.28	2.20	2.00		1.7
8		2.55	1.35	1.45	2.83	3.32	3.20	2.15	2.00		1.85
9		2.52	1.40	1.55	2.90	3.38	3.13	2.18	2.00		1.65
10		2.50	1.50	1.60	2.86		3.08	2.37	2.00		1.8
11		2.50	1.50	1.55	2.65	3.37	3.05	2.30	2.00		1.6
12		2.45	1.40	1.45	2.50	3.40	3.03	2.14	1.95		1.6
13		2.48	1.35	1.40		3.46	2.97	2.23	1.90		2.05
14	2.50	2.48	1.35	1.45		3.42	2.85	2.28	1.85		1.75
15	2.52	2.50	1.40			3.38	2.87	2.28	1.85		1.85
16	2.52	2.52	1.35			3.40	2.78	2.18			1.7
17	2.54	2.48	1.40				2.63	2.22		1.7	1.75
18	2.56	2.50	1.35				2.69	2.20		1.7	1.65
19	2.55	2.45	1.40				2.76	2.15		1.65	1.65
20	2.53	2.40	1.40		3.02		2.65	2.20		1.7	1.55
21	2.50	2.60	1.45		2.85		2.64	2.20		1.75	1.6
22	2.50	3.05	1.45		2.78		2.55	2.20			1.75
23	2.48	3.10	•1.40	1.85	2.69		2.55	2.35			1.7
24	2.50	3.20	1.40	1.76	2.62		2.60	2.35			1.9
25	2.52	3.10	1.45	1.88	2.75	3.30	2.65	2.35			1.7
26	2.53	2.35	1.70	1.95	2.93	3.22	2.60	2.40			1.85
27	2.55	2.35	1.55	2.00	3.05	3.00	2.65	2.30			1.8
28	2.60	2.38	1.40	2.25	2.98	2.98	2.50	2.30		1.65	1.95
29	2.75		1.35	2.45	3.00	3.00	2.53	2.20		1.85	2.0
30	2.80		1.40	2.37	3.00	2.93	2.45	2.10		1.6	1.75
31	2.74		1.40		3.12		2.45	2.05		1.65	

NOTE.—Gage heights Jan. 1 to Feb. 28 distorted by ice.

Daily discharge, in second-feet, of Boulder Creek at Orodell, Colo., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	5	7	2	4	78	228	165	66	50	.....	12
2	5	6	2	5.5	93	246	194	92	44	.....	12
3	5	6	3	7	86	274	240	83	44	.....	12
4	5	7	3	10	66	220	260	77	40	.....	15
5	5	6	3.5	7	71	260	274	66	40	.....	15
6	4	5	3.5	20	92	260	260	54	40	.....	15
7	4	5	3.5	5.5	124	325	282	56	35	.....	15
8	4	5	3.5	5.5	167	380	260	50	35	.....	24
9	4	5	4	8.5	183	433	241	54	35	.....	12
10	4	6	7	10	174	423	228	78	35	.....	20
11	3	6	7	8.5	128	414	220	68	35	.....	10
12	3	5	4	5.5	100	417	214	49	31	.....	10
13	3	5	3.5	4	115	428	199	60	27	.....	40
14	2.5	5	3.5	5.5	130	413	172	69	24	.....	18
15	2.5	6	4	8	145	390	156	66	24	.....	24
16	2.5	6	3.5	10	155	388	156	54	.....	.....	15
17	2.5	6	4	12	165	374	124	58	.....	15	18
18	2.5	6	3.5	15	180	360	137	56	.....	15	12
19	2.5	5	4	17	195	350	152	50	.....	12	12
20	2.5	5	4	19	211	340	128	56	.....	15	8
21	2.5	7	5.5	21	172	330	126	50	.....	18	10
22	2.5	9	5.5	22	156	320	109	56	.....	18	18
23	2.5	23	4	24	137	310	109	76	.....	18	15
24	2.5	18	4	18	122	300	118	76	.....	15	27
25	2.5	12	5.5	26	150	294	128	76	.....	15	15
26	2.5	2	15	31	190	265	118	83	.....	15	24
27	2.5	2	8.5	35	220	206	128	68	.....	12	20
28	5	2	4	62	204	204	100	68	.....	12	31
29	8	.....	3.5	92	200	200	105	56	.....	24	35
30	9	.....	4	78	206	190	92	44	.....	10	18
31	8	.....	4	.....	258	.....	92	40	.....	12	.....

NOTE.—Daily discharge estimated, because of ice, Jan. 1 to Feb. 28. Discharge interpolated for days for which gage heights are missing.

Monthly discharge of Boulder Creek at Orodell, Colo., for 1911.

[Drainage area, 108 square miles.]

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	9	2.5	3.5	236
February	23	2	6.7	373
March	15	2	4.4	270
April	92	4	20	1,180
May	238	62	150	9,240
June	433	190	318	18,900
July	282	92	171	10,500
August	92	40	63	3,880
September 1-15	50	24	36	1,070
October 17-31	24	10	15	448
November	40	8	17	1,060
The period				47,200

SOUTH BOULDER CREEK NEAR ROLLINSVILLE, COLO.

Location.—At highway bridge in sec. 35, T. 1 S., R. 73 W., 1 mile west of Rollinsville, in the Pike National Forest. The nearest important tributary, Jennie Creek, enters 3 miles above.

Records available.—September 10, 1910, to December 31, 1911.

Drainage area.—39 square miles (measured from topographic sheets).

Gage.—Vertical staff.

Channel.—Fairly permanent.

Discharge measurements.—Made from bridge during high water and by wading at ordinary stages.

Winter flow.—Ice causes backwater during the winter months.

Diversions.—There are no court decrees for diversions above the station, and therefore it is probable that the records represent the natural run-off.

Accuracy.—Conditions are favorable for fairly accurate results and the estimates of discharge should be reliable.

Cooperation.—Station is maintained in cooperation with the United States Forest Service.

Discharge measurements of South Boulder Creek near Rollinsville, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 16[a]	R. H. Fletcher	1.10	8.1
Apr. 6	do	1.05	17.9
June 30	E. O. Christiansen	1.75	91.8
Sept. 17	H. B. Waha	1.10	17.4
Dec. 6[a]	do	.98	8.5

[a] Ice conditions.

Daily gage height, in feet, and discharge, in second-feet, of South Boulder Creek near Rollinsville, Colo., for 1910.

[F. D. Whitney, observer.]

Day.	September.		October.		Day.	September.		October.	
	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.
1			0.80	5	16		11		
2			.80	5	17		10		
3			.80	5	18	.90	9		
4			.85	7	19		9		
5			.90	9	20	.90	9		
6			.90	9	21	.95	12		
7					22	.90	9		
8					23	.90	9		
9					24		7		
10	0.90	9			25	.80	5		
11	.90	9			26		5		
12	.95	12			27		5		
13	.95	12			28		5		
14	.95	12			29		5		
15	.95	12			30		5		

Daily gage height, in feet, of South Boulder Creek near Rollinsville, Colo., for 1911.

[Ray R. Clarke, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1			0.91		1.17			1.40				
2		0.89	.92	0.99					1.36	1.15		
3		.86	.90	1.00		2.20		1.35				
4		.87	.87		1.36	2.20	2.00	1.30		1.15		
5		.90		1.00	1.38	2.20			1.25			
6		.85	.85	1.05	1.55		2.30				1.30	0.98
7		.86	.90			2.20	2.10	1.45	1.22	1.20		
8		.89	.84	1.02	1.62		2.00	1.40	1.20		1.18	
9		.85			1.78					1.20		
10						2.25		1.35				
11		1.00		.98						1.50		1.20
12		.90			1.78	3.00	1.90	1.30				1.30
13		.96		1.04	1.70	2.20	1.80		1.15			
14		.94	.95		1.80	1.68	1.80					
15			.94	.81	1.90		1.75	1.30	1.18			
16		.90	.98	.90			1.75		1.35	1.50		1.40
17		.89	.93		2.00	2.15	1.75	1.30	1.15		1.20	
18			.98		2.00	2.15		1.30			1.10	
19		.95		1.08	2.20			1.30	1.15			
20		.92	.97			2.15	1.65	1.32		1.30	1.05	
21		.89	1.00				1.65		1.10			
22	0.82	.88	.90	1.10					1.10			
23	.78		.92		1.90	1.95			1.10		1.00	
24		.91	.92		1.80	1.90			1.10	1.30		
25	.92	.90	.96	1.10			1.50	1.45		1.20	1.02	
26	.94	.90		1.20		1.80		1.38				
27	.95	.93	.92	1.40	2.00	1.80	1.45			1.20		
28	.92	.91	.95	1.44							1.00	
29			.96		2.20	1.80	1.50	1.38	1.12			
30	.88		.92		2.00	1.75					1.00	
31	.88				2.10		1.45					

NOTE.—Ice caused backwater approximately Jan. 1 to Apr. 15 and Nov. 17 to Dec. 31.

Daily discharge, in second-feet, of South Boulder Creek near Rollinsville, Colo., for 1911.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		24			46			
2						42	22	
3			168		40			
4		42	168	131	35		22	
5		44	168			30		
6		64		187				35
7			168	149	52	28	26	
8		74		131	46	26		25
9		97					26	
10			178		40			
11							58	
12		97	335	115	35			
13		85	168	100		22		
14		100	82	100				
15		115		92	35	25		
16	8			92		40	58	
17		131	158	92	35	22		
18		131	158		35			
19	18	168			35	22		
20			158	78	37		35	
21				78		19		
22	19					19		
23		115	123			19		
24		100	115			19	35	
25	19			58	52		26	
26	26		100		44			
27	46	131	100	52			26	
28	51							
29		168	100	58	44	20		
30		131	92					
31		149		52				

SOUTH BOULDER CREEK AT ELDORADO SPRINGS, COLO.[1]

Location.—At the mouth of the canyon at Eldorado Springs, in sec. 30, T. 1 S., R. 70 W., 3 miles southwest of Marshall. No important tributaries within several miles.

Records available.—May 15, 1895, to September 30, 1901; July 1, 1904, to December 31, 1911.

Drainage area.—125 square miles (measured from topographic sheets).

Gage.—Vertical staff; datum unchanged.

Channel.—Not known, as only the computed estimates are received.

Discharge measurements.—Made by wading.

Winter flow.—Ice causes backwater during the winter months, and measurements are made to determine the flow.

Diversions.—There are court decrees for diversions of 137 second-feet above the station and 1,658 second-feet below. There are also a number of flood-water decrees.

Cooperation.—Since 1904 the station has been maintained by the State engineer by whom the records are furnished. The records for 1904 to 1908 were published only in the reports of the State engineer.

Discharge measurements of South Boulder Creek at Eldorado Springs, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 10	C. E. Turner	0.71	12.0	June 8	C. C. Hezmalhalch	2.25	230
Mar. 10	do	1.16	16.3	Aug. 2	do	1.30	34.0
10	do	1.16	17.3	23	do	1.80	80.0
Apr. 13	do	1.12	12.8	Sept. 15	do	1.15	17.2
May 19	do	2.20	207	Dec. 15	C. E. Turner	.92	7.3

Daily gage height, in feet, of South Boulder Creek at Eldorado Springs, Colo., for 1911.

[B. E. Cheseboro, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.9	1.1	0.9	1.20	1.6	2.3	1.8	1.45	1.25	1.2	1.2	1.1
2	.85	1.0	.95	1.2	1.55	2.45	2.0	1.4	1.2	1.2	1.0	1.1
3	.9	1.0	1.0	1.2	1.6	2.45	2.2	1.4	1.3	1.1	1.15	1.1
4	.9	1.0	1.0	1.2	1.65	2.3	2.25	1.4	1.3	1.15	1.15	1.05
5	.9	1.05	1.0	1.25	1.65	2.4	2.2	1.35	1.3	1.1	1.1	1.05
6	.9	.95	1.0	1.2	1.75	2.35	2.25	1.35	1.25	1.25	1.1	1.0
7	.9	.95	1.05	1.2	1.9	2.3	2.2	1.3	1.2	1.25	1.0	1.0
8	.95	1.0	1.1	1.2	1.95	2.35	2.1	1.25	1.2	1.2	1.15	1.0
9	.9	1.0	1.1	1.3	1.95	2.5	2.0	1.25	1.15	1.2	1.1	.9
10	1.0	1.0	1.1	1.2	2.05	2.4	1.9	1.3	1.15	1.2	1.1	.95
11	1.0	1.0	1.2	1.25	1.9	2.3	1.9	1.65	1.15	1.2	1.1	.95
12	1.0	1.0	1.1	1.25	1.9	2.3	1.85	1.6	1.15	1.2	1.0	.9
13	1.05	1.0	1.1	1.2	1.95	2.35	1.85	1.5	1.15	1.2	1.0	.9
14	1.0	1.0	1.1	1.2	2.0	2.3	1.95	1.35	1.15	1.2	1.05	.9
15	1.0	1.0	1.1	1.2	2.0	2.35	1.9	1.35	1.2	1.2	1.15	.9
16	1.0	1.0	1.2	1.2	2.1	2.35	1.9	1.35	1.15	1.1	1.15	.95
17	1.0	1.0	1.15	1.25	2.1	2.35	1.8	1.3	1.1	1.2	1.05	.95
18	1.0	1.0	1.2	1.2	2.15	2.15	1.8	1.3	1.1	1.2	1.05	.95
19	1.0	1.0	1.2	1.25	2.25	2.15	1.8	1.3	1.1	1.1	1.1	.95
20	1.0	.9	1.15	1.3	2.1	2.15	1.7	1.3	1.1	1.1	1.1	.95
21	1.0	.9	1.2	1.35	2.0	2.3	1.7	1.4	1.15	1.2	1.05	.95
22	1.0	.9	1.2	1.4	1.95	2.35	1.7	1.55	1.1	1.15	1.05	.95
23	1.0	.9	1.2	1.45	1.9	2.35	1.7	1.7	1.1	1.1	1.0	.95
24	1.0	.95	1.2	1.4	1.9	2.1	1.65	1.6	1.1	1.1	1.1	.95
25	1.05	1.0	1.2	1.4	2.0	2.1	1.6	1.5	1.1	1.1	1.1	.95
26	1.05	1.0	1.2	1.45	2.05	2.0	1.6	1.4	1.05	1.15	1.05	.95
27	1.05	1.0	1.2	1.5	2.1	1.95	1.55	1.4	1.05	1.1	1.0	.95
28	1.0	.9	1.2	1.6	2.15	1.95	1.5	1.35	1.05	1.1	.9	.95
29	1.1	.....	1.2	1.65	2.1	1.95	1.5	1.3	1.05	1.05	1.0	.95
30	1.1	.....	1.2	1.55	2.2	1.9	1.5	1.25	1.1	1.0	1.1	.95
31	1.1	.....	1.2	.....	2.3	.....	1.5	1.2	.....	1.05	.....	.....

NOTE.—Ice present Jan. 1 to Mar. 2.

[1] Called South Boulder Creek near Marshall in 1910 report.

Daily discharge, in second-feet, of South Boulder Creek at Eldorado Springs, Colo., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4	2	6	20	58	246	104	48	21	20	20	14
2	4	2	8	20	52	316	153	43	18	20	9	14
3	4	2	9	20	58	316	212	41	25	14	17	14
4	4	2	9	20	66	246	231	41	25	17	17	12
5	4	2	9	24	96	292	212	38	25	14	14	12
6	4	2	9	20	84	269	231	38	21	24	14	9
7	4	2	12	20	117	246	212	33	18	24	9	9
8	4	2	14	20	130	269	181	29	19	20	17	9
9	4	1	14	27	130	340	153	28	15	20	14	6
10	4	1	14	20	159	293	127	32	16	20	14	8
11	4	1	20	24	117	250	127	75	17	20	14	8
12	4	1	14	24	117	250	116	66	17	20	9	6
13	4	1	14	20	130	272	116	50	17	20	9	6
14	4	1	14	20	144	250	140	33	17	20	12	6
15	4	1	14	20	144	272	127	33	20	20	17	6
16	3	2	20	20	174	272	127	32	17	14	17	8
17	3	2	17	24	174	231	104	27	14	20	12	8
18	3	2	20	20	191	196	104	27	14	20	12	8
19	3	2	20	24	227	196	104	25	14	14	14	8
20	3	4	17	27	174	196	85	24	14	14	14	8
21	3	4	20	31	144	250	85	31	17	20	12	8
22	3	4	20	35	130	272	85	45	14	17	12	8
23	3	4	20	40	117	231	85	68	14	14	9	8
24	3	7	20	35	117	181	76	50	14	14	14	8
25	3	9	20	35	144	181	68	39	14	14	14	8
26	2	9	20	40	159	153	68	30	12	17	12	8
27	2	9	20	45	174	140	61	30	12	14	9	8
28	2	6	20	58	191	140	54	27	12	14	6	8
29	2	.....	20	66	174	140	54	23	12	12	9	8
30	2	.....	20	52	208	127	54	20	14	9	14	8
31	2	.....	20	.....	246	.....	54	17	.....	12	.....	8

NOTE.—Discharge estimated Jan. 1 to Mar. 2.

Monthly discharge of South Boulder Creek at Eldorado Springs, Colo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	4	2	3.3	202
February	9	1	3.1	173
March	20	6	16	980
April	66	20	29	1,730
May	246	52	139	8,560
June	340	127	234	14,000
July	231	54	120	7,360
August	75	17	37	2,280
September	25	12	17	990
October	24	9	17	1,020
November	20	6	13	766
December	14	6	8.6	530
The year	340	1	53.2	38,600

BIG THOMPSON CREEK NEAR ARKINS, COLO.

Location.—At private bridge at the mouth of the canyon, in sec. 10, T. 5 N., R. 70 W., 2 miles southwest of Arkins; nearest perennial tributary, Buckhorn Creek, enters several miles below.

Records available.—April 1, 1888, to October 31, 1890; May 9, 1895, to September 2, 1903; July 16, 1904, to August 31, 1911. The records from 1904 to 1908 were published only in the reports of the State engineer.

Drainage area.—305 square miles.

Gage.—Vertical staff gage which remained unchanged from April 1, 1899, to July 16, 1904, when it was washed out. A second gage was installed at that time, which was referred to a different datum. In the spring of 1909 a third gage was installed, which was referred to a third datum.

Channel.—Practically permanent except during extreme flood stages.

Discharge measurements.—Made from bridge.

Winter flow.—Ice causes backwater during a portion of the winter months, and measurements are made to determine the discharge.

Diversions.—There is a court decree for a diversion of 198 second-feet from Big Thompson Creek above the station. Below, there are decrees for diversions of 2,624 second-feet from Big Thompson Creek, and flood-water diversions of 24,800 acre-feet.

Cooperation.—From 1888 to 1890 and subsequent to 1903 this station has been maintained by the State engineer, by whom the records are furnished.

Discharge measurements of Big Thompson Creek near Arkins, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 8[a]	C. E. Turner	0.96	6.5	June 19	C. E. Turner	2.68	519
Mar. 8	do	1.12	29.6	July 30	C. C. Hezmalhalch	1.80	157
Apr. 12	do	1.13	35.5	Aug. 20	do	1.55	103
27	do	1.30	65.3	Oct. 15	C. E. Turner	1.23	59.6
May 17	do	2.19	319	Dec. 14[a]	do	1.05	16.2

[a] Ice condition.

Daily gage height, in feet, and discharge, in second-feet, of Big Thompson Creek near Arkins, Colo., for 1911.

[J. F. Wagener, observer.]

Day.	May.		June.		July.		August.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			2.65	500	2.3	362	1.7	134
2			2.8	560	2.55	460	1.65	124
3			2.65	500	2.75	540	1.6	114
4			2.75	540	2.75	540	1.6	114
5			2.75	520	2.75	540	1.6	114
6			2.7	520	2.6	477	1.55	105
7			2.8	560	2.55	455	1.6	114
8			2.85	581	2.5	435	1.55	105
9			3.0	644	2.55	453	1.5	96
10			2.8	560	2.3	355	1.55	105
11	2.0	255	2.75	540	2.2	315	1.7	134
12	1.9	222	2.8	560	2.1	280	1.65	124
13	2.0	255	2.95	623	2.1	280	1.5	96
14	2.05	272	2.85	581	2.2	313	1.5	96
15	2.2	325	2.95	623	2.15	293	1.5	96
16	2.35	381	2.95	623	2.2	310	1.55	105
17	2.3	362	3.05	665	2.15	290	1.6	114
18	2.3	362	2.75	540	2.10	270	1.55	105
19	2.35	381	2.8	560	2.3	340	1.45	88
20	2.1	290	2.85	581	2.2	305	1.5	96
21	1.95	238	2.95	623	2.1	267	1.6	114
22	1.85	207	3.0	644	2.2	300	1.65	124
23	1.9	222	2.8	560	2.3	338	1.95	196
24	2.0	255	2.75	540	2.15	280	1.85	170
25	2.1	290	2.65	500	2.05	245	1.7	134
26	2.3	362	2.45	420	1.95	210	1.6	114
27	2.25	344	2.4	400	1.95	210	1.5	96
28	2.2	325	2.45	420	1.9	193	1.45	88
29	2.2	325	2.5	440	1.8	160	1.4	80
30	2.35	381	2.35	381	1.75	145	1.4	80
31	2.55	460			1.75	145	1.35	74

Monthly discharge of Big Thompson Creek near Arkins, Colo., for 1911.

[Drainage area, 305 square miles.]

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May 11–31	460	207	310	12,900
June	644	381	544	32,400
July	540	145	326	20,000
August	196	74	111	6,840

CACHE LA POUDRE RIVER NEAR ELKHORN, COLO.

Location.—At the lower bridge at Fry's ranch in the southern part of T. 9 N., R. 73 W., 7 miles southwest of Elkhorn post office.

Records available.—January 6, 1909, to December 31, 1911.

Drainage area.—250 square miles (measured from King's Atlas).

Gage.—Chain gage; datum unchanged.

Channel.—Fairly permanent.

Discharge measurements.—Made from bridge.

Winter flow.—Ice causes backwater during the winter months and frequent measurements are made to determine the discharge.

Diversions.—There are no diversions from the Cache la Poudre above the station, but the flow is increased by a diversion from Laramie River by the Skyline ditch which has a court decree for 400 second-feet.

Artificial control.—The flow is controlled to a certain extent by the reservoir at Chambers Lake, which is operated in the interest of irrigation diversions below.

Accuracy.—As the estimates of discharge are based on very frequent discharge measurements they should be excellent.

Cooperation.—Station maintained in cooperation with private persons through Mr. George B. McFadden, of Denver.

Discharge measurements of Cache la Poudre River near Elkhorn, Colo., in 1911.

[N. W. Fry and H. Mertens, hydrographers.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Jan. 5	3.48	26	Feb. 1	2.44	30	Mar. 6	2.38	29
7	3.34	28	2	2.07	10	7	2.28	20
8	3.17	25	3	2.03	10	7	2.54	34
9	2.78	17	4	2.02	18	8	2.29	25
10	2.64	21	6	2.25	18	9	2.30	24
11	2.62	18	7	2.11	11	10	2.38	32
12	2.56	24	8	2.13	13	11	2.26	28
13	2.56	26	9	2.14	14	12	2.39	31
14	2.59	30	10	2.24	17	13	2.73	60
15	2.60	32	11	2.28	19	14	2.60	41
16	2.70	34	12	2.32	23	15	2.70	39
17	2.59	35	13	2.38	25	16	2.41	33
18	2.57	33	14	2.24	21	18	2.36	31
19	2.45	31	15	2.16	15	19	2.38	33
20	2.40	24	16	2.33	24	20	2.36	35
24	2.49	30	17	2.23	23	21	2.31	29
25	2.53	37	24	3.12	39	22	2.34	29
26	2.53	40	25	2.33	24	24	2.31	29
27	2.49	33	Mar. 1	2.51	25	26	3.30	34
28	2.57	43	2	2.24	22	27	2.67	56
29	2.53	40	3	2.52	24	28	2.23	28
30	2.70	43	4	2.28	20	29	2.56	45
31	2.69	43	5	2.31	25	30	2.09	15

Discharge measurements of Cache la Poudre River near Elkhorn, Colo., in 1911—Contd.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Mar. 31	2.20	21	June 22	6.14	1,560	Sept. 10	2.86	79
Apr. 1	2.29	27	23	5.92	1,170	11	2.83	74
2	2.37	33	24	5.82	1,110	12	2.86	80
3	2.46	39	25	5.50	996	13	2.86	84
4	2.49	39	27	5.34	849	14	2.90	84
5	2.40	35	28	5.30	801	15	2.90	88
6	2.37	33	29	5.28	802	15	2.90	82
7	2.29	24	30	5.00	633	16	2.87	80
8	2.19	19	July 1	4.91	567	17	2.80	68
9	2.50	39	2	5.72	1,040	18	2.73	59
10	2.48	41	3	5.78	1,030	19	2.68	58
11	2.36	30	4	5.27	800	20	2.68	58
12	2.41	35	5	5.22	797	21	2.66	62
15	2.44	32	6	5.22	802	22	2.63	54
16	2.12	16	7	5.06	679	23	2.70	62
17	2.39	32	8	4.98	623	24	2.90	84
18	2.39	33	9	4.98	588	25	2.92	85
19	2.38	33	10	4.78	477	26	2.76	67
20	2.49	41	11	4.50	444	27	2.50	43
21	2.50	43	12	4.38	424	28	2.92	86
22	2.59	49	13	4.40	385	29	3.23	137
23	2.71	63	14	4.70	480	30	3.27	87
24	2.74	67	15	4.78	495	Oct. 1	3.27	156
25	2.71	65	16	4.96	578	2	3.20	125
26	2.68	63	17	4.62	416	3	3.10	121
27	2.92	91	18	4.40	378	[illegible]	3.08	108
28	3.04	103	19	4.54	400	5	3.14	122
30	3.01	106	20	4.42	384	6	3.53	192
May 1	2.92	91	21	4.37	362	7	3.36	169
2	2.87	89	22	4.36	389	8	3.28	151
3	2.86	83	23	4.38	350	9	3.12	114
4	2.92	99	24	4.20	268	10	2.76	70
5	3.17	134	25	4.12	253	11	3.08	111
6	3.56	197	26	4.02	232	12	3.00	99
7	3.70	307	27	4.00	239	13	2.92	89
8	4.26	386	28	3.94	221	14	2.98	96
9	4.41	469	30	3.78	176	16	2.76	69
10	4.84	582	31	3.68	164	17	2.96	91
11	4.33	423	Aug. 1	3.66	154	19	3.00	98
12	4.30	421	2	3.60	162	21	2.38	40
13	4.44	532	3	3.56	160	22	2.68	55
14	4.90	628	4	3.50	135	23	3.02	97
15	5.13	723	5	3.48	135	24	2.96	89
16	5.33	844	6	3.60	170	25	2.96	87
17	5.43	858	7	3.60	166	28	2.32	39
18	5.61	1,040	8	3.36	134	29	2.60	45
19	5.48	1,130	9	3.30	118	30	2.82	72
20	5.00	639	10	3.32	127	31	2.76	71
21	4.57	514	11	3.62	168	Nov. 2	2.56	48
22	4.52	468	12	3.60	165	3	2.72	63
23	4.54	488	13	3.36	123	4	2.90	75
24	4.98	500	14	3.23	112	5	2.67	60
25	5.23	811	15	3.21	104	7	2.57	46
26	5.52	961	16	3.19	96	8	2.76	70
27	5.20	756	17	3.20	100	10	2.78	69
28	5.28	787	18	3.19	106	15	3.07	55
29	5.50	958	19	3.18	102	16	2.98	52
30	5.62	1,030	20	3.16	98	18	2.84	72
31	5.90	1,230	21	3.40	128	19	2.70	41
June 1	6.10	1,380	22	3.40	129	20	2.54	36
2	6.20	1,660	23	4.00	251	21	2.50	35
3	6.16	1,540	24	3.56	163	22	2.54	36
4	5.98	1,380	25	3.36	123	24	2.87	36
5	6.10	1,420	26	3.26	108	25	2.84	31
6	6.14	1,490	27	3.12	99	Dec. 1	2.97	37
7	6.16	1,480	28	3.07	97	2	2.59	27
8	6.26	1,930	29	3.10	102	3	2.49	26
9	6.46	2,090	30	3.00	87	4	2.43	21
10	6.20	1,740	31	2.94	73	5	2.47	23
11	6.14	1,660	Sept. 1	2.94	70	6	2.37	19
12	6.20	1,820	2	3.02	82	7	2.43	22
13	6.24	1,770	3	3.00	75	8	2.38	21
14	6.20	1,670	4	3.10	94	9	2.38	21
15	6.10	1,590	5	3.08	88	12	2.53	28
17	6.30	1,970	6	3.00	104	15	2.73	24
18	6.15	1,540	7	3.04	106	17	2.78	28
19	6.08	1,380	8	2.98	92	22	2.86	25
20	6.10	1,440	9	2.90	87	23	2.89	28
21	6.08	1,510						

Daily gage height, in feet, of Cache la Poudre River near Elkhorn, Colo., for 1911.

[N. W. Fry, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.22	2.44	2.51	2.29	2.92	6.10	4.91	3.66	2.94	3.27	2.80	2.97
2	2.41	2.07	2.44	2.37	2.87	6.20	5.72	3.60	3.02	3.20	2.56	2.59
3	2.48	2.03	2.52	2.46	2.86	6.16	5.78	3.56	3.00	3.10	2.72	2.49
4	2.70	2.48	2.28	2.49	2.92	5.98	5.27	3.50	3.10	3.08	2.90	2.43
5	3.48	2.34	2.31	2.40	3.17	6.10	5.22	3.48	3.08	3.14	2.67	2.47
6	3.60	2.44	2.38	2.37	3.56	6.14	5.22	3.60	3.00	3.53	2.80	2.37
7	3.34	2.11	2.54	2.29	3.70	6.16	5.06	3.60	3.04	3.36	2.57	2.43
8	3.17	2.13	2.29	2.19	4.26	6.26	4.98	3.36	2.98	3.28	2.76	2.38
9	2.78	2.14	2.30	2.50	4.41	6.46	4.98	3.30	2.90	3.12	2.60	2.38
10	2.64	2.24	2.38	2.48	4.84	6.20	4.78	3.32	2.86	2.76	2.78	2.60
11	2.62	2.28	2.26	2.36	4.33	6.14	4.50	3.62	2.83	3.08	2.50	2.53
12	2.56	2.32	2.39	2.41	4.30	6.20	4.38	3.60	2.86	3.00	1.98	2.53
13	2.56	2.38	2.73	2.18	4.44	6.24	4.40	3.36	2.88	2.92	3.00	2.87
14	2.59	2.24	2.60	2.34	4.90	6.20	4.70	3.23	2.90	2.98	3.13	2.83
15	2.60	2.16	2.50	2.44	5.13	6.10	4.78	3.21	2.90	3.03	3.07	2.73
16	2.70	2.33	2.41	2.12	5.33	6.30	4.96	3.19	2.87	2.76	2.98	2.78
17	2.59	2.23	2.35	2.39	5.43	6.35	4.62	3.20	2.80	2.96	3.23	2.78
18	2.57	2.45	2.36	2.39	5.61	6.15	4.40	3.19	2.73	3.00	2.84	2.87
19	2.45	2.54	2.38	2.38	5.48	6.08	4.54	3.18	2.68	3.00	2.70	2.92
20	2.40	2.52	2.36	2.49	5.00	6.10	4.42	3.16	2.68	2.98	2.54	2.90
21	2.47	2.34	2.31	2.50	4.57	6.08	4.37	3.40	2.66	2.38	2.50	2.87
22	2.36	2.36	2.34	2.59	4.52	6.14	4.36	3.40	2.63	2.68	2.54	2.86
23	2.57	2.64	2.24	2.71	4.54	5.92	4.38	4.00	2.70	3.02	2.38	2.89
24	2.49	3.12	2.31	2.74	4.98	5.82	4.20	3.56	2.90	2.96	2.87	2.90
25	2.53	2.33	2.13	2.71	5.23	5.50	4.12	3.36	2.92	2.96	2.84	2.94
26	2.53	2.42	3.30	2.68	5.52	5.40	4.02	3.26	2.76	2.90	2.64	3.00
27	2.49	2.36	2.67	2.92	5.20	5.34	4.00	3.12	2.50	2.84	3.02	3.14
28	2.57	2.35	2.23	3.04	5.28	5.30	3.94	3.07	2.92	2.32	2.70	3.26
29	2.53	.....	2.56	3.20	5.50	5.28	3.80	3.10	3.23	2.60	2.85	3.36
30	2.70	.....	2.09	3.01	5.62	5.00	3.78	3.00	2.92	2.82	2.92	3.80
31	2.69	.....	2.20	.....	5.90	.....	3.68	2.94	.....	2.76	.....	3.72

NOTE.—Ice caused backwater Jan. 1 to Apr. 1 and Nov. 24 to Dec. 31.

Daily discharge, in second-feet, of Cache la Poudre River near Elkhorn, Colo., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	26	30	25	27	77	1,490	565	176	79	119	65	37
2	26	10	22	31	72	1,590	1,140	166	87	110	45	27
3	26	10	24	37	71	1,550	1,190	160	85	97	58	26
4	26	18	20	39	77	1,370	779	151	97	95	75	21
5	26	18	25	33	106	1,490	744	148	95	102	54	23
6	27	18	29	31	160	1,530	744	166	85	156	65	19
7	28	11	27	26	182	1,550	646	166	90	131	46	22
8	25	13	25	20	308	1,660	600	131	83	120	61	21
9	17	14	24	40	353	1,880	600	123	75	100	48	21
10	21	17	32	39	530	1,590	500	126	71	61	63	23
11	18	19	28	31	329	1,530	380	169	68	95	40	25
12	24	23	31	34	320	1,590	344	166	71	85	11	28
13	26	25	60	20	362	1,630	350	131	73	77	85	27
14	30	21	41	29	560	1,590	460	114	75	83	101	25
15	32	15	39	36	688	1,490	500	111	75	89	93	24
16	34	24	33	17	821	1,700	590	109	72	64	83	26
17	35	23	32	32	894	1,760	428	110	65	81	114	28
18	33	25	31	32	1,040	1,540	350	109	59	85	69	27
19	31	27	33	32	934	1,470	396	107	54	85	56	27
20	24	29	35	39	610	1,490	356	105	54	83	43	26
21	26	31	29	40	408	1,470	341	137	53	32	40	26
22	27	33	29	47	388	1,530	338	137	50	54	43	25
23	28	36	29	57	396	1,320	344	240	56	87	32	28
24	30	39	29	60	600	1,230	290	160	75	81	32	27
25	37	24	32	57	751	950	270	131	77	81	33	26
26	40	24	34	54	966	870	245	118	61	75	33	25
27	33	24	56	77	730	828	240	100	40	69	34	25
28	43	25	28	90	786	800	228	93	77	28	35	25
29	40	.....	45	110	950	786	200	97	114	48	36	25
30	43	.....	15	86	1,050	610	196	85	77	67	37	25
31	43	.....	21	.....	1,300	.....	179	79	.....	61	.....	25

NOTE.—Daily discharge determined from a rating curve that is very well defined. Discharge estimated or interpolated Jan. 1 to 4, 6, 21, 23, Feb. 5, 18 to 23, 26 to 28, Mar. 17, 23, 25, and Nov. 24 to 30, Dec. 10, 11, 13, 14, 16, 18 to 21 and 24 to 31. Discharge obtained from discharge measurements for other days between Jan. 1 and Apr. 1 and Nov. 24 and Dec. 31.

Monthly discharge of Cache la Poudre River near Elkhorn, Colo., for 1911.

[Drainage area, 250 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	43	17	29.8	0.119	0.14	1,830	B.
February	39	10	22.3	.089	.09	1,240	B.
March	60	15	31.1	.124	.14	1,910	B.
April	110	17	43.4	.174	.19	2,580	A.
May	1,300	71	543	2.17	2.50	33,400	A.
June	1,880	610	1,400	5.60	6.25	83,300	A.
July	1,190	179	469	1.88	2.17	28,800	A.
August	240	79	133	.532	.61	8,180	A.
September	114	40	73.1	.292	.33	4,350	A.
October	156	28	83.8	.335	.39	5,150	A.
November	114	11	54.3	.217	.24	3,230	A.
December	37	19	25.3	.101	.12	1,560	B.
The year	1,880	10	242	.969	13.17	176,000	

CACHE LA POUDRE RIVER NEAR FORT COLLINS, COLO.

Location.—In sec. 33, T. 9 N., R. 70 W., 1,000 feet below the intake for the Fort Collins waterworks, 15 miles above Fort Collins, 500 yards above junction with North Fork.

Records available.—January 8, 1909, to December 31, 1911.

Drainage area.—495 square miles (measured from King's Atlas).

Gage.—Vertical staff; datum unchanged.

Channel.—Fairly permanent.

Discharge measurements.—Made from car and cable.

Winter flow.—Ice causes backwater during the winter months, and frequent measurements are made to determine the discharge.

Diversions.—There are no diversions between this station and the one above, near Elkhorn, except the intake for the Fort Collins waterworks.

Accuracy.—As the estimates of discharge are based on very frequent discharge measurements they should be excellent.

Cooperation.—Station maintained in cooperation with private persons through Mr. George B. McFadden, of Denver.

Discharge measurements of Cache la Poudre River near Fort Collins, Colo., in 1911.

Date.		Hydrographer.	Gage height.	Discharge.	Date.		Hydrographer.	Gage height.	Discharge.
			Feet.	*Sec.-ft.*				*Feet.*	*Sec.-ft.*
Jan.	1	F. H. Stearley	2.35	48	Mar.	5	Fletcher and Stearley	2.00	45
	5	do	2.5	60		5	do	2.00	43
	10	do	2.5	61		8	F. H. Stearley	2.00	53
	15	do	2.5	63		11	do	2.00	53
	17	do	2.35	48		14	do	1.90	62
	20	do	2.3	54		16	do	2.00	63
	23	do	2.15	25		20	do	2.00	62
	26	do	2.3	53		24	do	2.00	62
Feb.	1	do	2.2	50		27	do	1.75	28
	4	do	1.75	29		30	do	1.75	29
	7	do	1.85	40	Apr.	2	do	1.90	51
	10	do	2.00	57		9	do	1.90	48
	17	do	1.90	46		11	Miles and Turner	2.00	51
	21	do	2.00	42		12	F. H. Stearley	2.00	62
	24	do	2.00	42		15	do	2.00	58
	28	do	2.15	45		18	do	1.95	58
Mar.	2	do	2.20	47		20	do	1.95	55
	4	do	2.25	48		24	do	2.2	104

Discharge measurements of Cache la Poudre River near Fort Collins, Colo., in 1911.—Continued.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 1	F. H. Stearley	2.60	170	Sept. 15	F. H. Stearley	2.30	103
4	do	2.90	271	18	do	2.25	92.9
6	do	3.10	317	21	do	2.20	86.4
9	do	4.00	676	25	do	2.25	117
14	do	4.30	869	29	do	2.30	101
20	do	4.40	924	Oct. 1	do	2.50	169
22	do	4.00	691	6	do	2.75	209
24	do	4.30	868	9	do	2.50	163
June 2	do	5.90	2,110	13	do	2.60	179
7	do	5.80	2,030	16	do	2.40	146
15	do	5.80	2,070	19	do	2.35	93.3
21	do	5.80	2,030	23	do	2.70	193
27	do	4.90	1,240	28	do	2.20	83.7
29	do	4.70	1,140	Nov. 1	do	2.20	98.9
July 5	do	4.70	1,140	4	do	2.10	86.2
11	do	4.00	705	8	do	2.15	80.2
15	do	4.00	709	10	do	2.25	98.5
19	do	3.80	656	12	do	1.80	37.3
23	do	3.90	674	16	do	2.15	82.4
Aug. 1	do	3.10	324	18	do	2.20	96.4
4	do	2.95	243	22	do	1.75	31.7
8	do	2.92	285	28	do	1.80	32.2
12	do	3.05	292	Dec. 2	do	2.30	53.3
16	do	2.75	215	6	do	2.30	51.2
22	do	3.00	247	10	do	2.30	47.3
30	do	2.55	148	14	do	2.10	44.1
Sept. 4	do	2.50	141	19	do	2.15	47.3
8	do	2.50	146	23	do	2.20	49.6
12	do	2.30	103	29	do	2.20	49.1

NOTE.—Ice present Jan. 1 to Mar. 4 and Dec. 2 to 29.

Daily gage height, in feet, of Cache la Poudre River near Fort Collins, Colo., for 1911.

[F. H. Stearley, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.35	2.10	2.20	1.90	2.65	5.50	4.35	3.05	2.42	2.60	2.18	2.30
2	2.40	1.98	2.25	1.90	2.75	5.80	4.90	3.05	2.45	2.65	2.18	2.35
3	2.50	1.85	2.28	1.92	2.85	5.55	5.05	2.95	2.45	2.70	2.08	2.32
4	2.50	1.78	2.28	2.00	2.95	5.55	4.75	2.93	2.42	2.72	2.08	2.40
5	2.50	1.82	2.00	2.00	3.05	5.85	4.65	3.05	2.45	2.78	2.08	2.35
6	2.50	1.85	2.00	2.00	3.20	5.87	4.55	2.95	2.45	2.72	2.05	2.30
7	2.55	1.88	2.00	1.95	3.60	5.87	4.55	2.92	2.45	2.62	2.08	2.30
8	2.50	1.95	2.00	1.90	3.85	5.75	4.45	2.85	2.45	2.60	2.12	2.28
9	2.50	2.05	2.00	1.90	4.20	5.90	4.35	2.80	2.35	2.45	2.12	2.22
10	2.50	2.05	2.00	2.00	4.35	5.75	4.25	3.10	2.35	2.45	2.23	2.30
11	2.50	2.05	2.00	2.00	3.75	5.55	4.02	3.05	2.25	2.72	1.95	2.25
12	2.50	1.92	1.95	2.00	4.05	5.45	4.05	2.98	2.25	2.65	1.72	2.20
13	2.50	1.90	1.88	2.00	4.20	5.40	3.95	2.90	2.25	2.55	1.85	2.15
14	2.50	1.92	1.95	2.05	4.45	5.50	3.92	2.78	2.25	2.45	2.00	2.15
15	2.48	1.90	2.00	2.00	4.80	5.70	4.10	2.75	2.25	2.45	2.10	2.15
16	2.40	1.90	2.00	2.00	5.10	5.70	4.20	2.72	2.25	2.35	2.15	2.10
17	2.35	1.90	2.00	1.95	5.15	5.35	3.90	2.75	2.22	2.35	2.18	2.12
18	2.35	1.90	2.00	1.92	5.00	5.45	3.85	2.72	2.20	2.32	2.15	2.15
19	2.30	1.95	2.00	1.92	4.85	5.35	3.75	2.75	2.18	2.32	2.05	2.15
20	2.30	1.98	2.00	1.98	4.35	5.35	3.72	2.78	2.15	2.38	1.95	2.18
21	2.28	2.00	2.02	2.05	4.25	5.65	3.75	2.92	2.18	2.25	1.95	2.12
22	2.22	2.00	2.05	2.12	4.00	5.40	3.75	2.92	2.28	2.15	1.85	2.2
23	2.18	2.00	2.00	2.18	4.15	5.20	3.85	3.02	2.45	2.70	1.85	2.18
24	2.20	2.00	2.00	2.20	4.45	5.10	3.60	2.95	2.28	2.50	1.85	2.15
25	2.22	2.00	2.00	2.28	4.75	4.90	3.50	2.95	2.20	2.35	2.00	2.15
26	2.30	2.05	1.85	2.30	4.85	4.90	3.50	2.72	2.22	2.25	1.95	2.15
27	2.30	2.10	1.80	2.45	4.90	4.80	3.42	2.65	2.18	2.18	2.00	2.12
28	2.22	2.12	1.82	2.58	5.00	4.70	3.40	2.55	2.25	2.15	1.88	2.15
29	2.20	.....	1.82	2.75	5.10	4.68	3.35	2.55	2.25	2.18	1.80	2.18
30	2.12	.....	1.78	2.75	5.10	4.5	3.25	2.48	2.25	2.18	1.90	2.20
31	2.15	.....	1.90	.....	5.35	.....	3.25	2.45	.....	2.15	.....	2.20

Daily discharge, in second-feet, of Cache la Poudre River near Fort Collins, Colo., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	48	50	47	49	178	1,760	900	292	129	165	88	51
2	51	43	47	49	202	2,030	1,270	292	135	178	88	53
3	54	36	48	52	230	1,800	1,390	260	135	190	73	53
4	57	29	48	62	260	1,800	1,160	254	129	195	73	52
5	60	32	62	62	292	2,080	1,080	292	135	210	73	51
6	60	36	62	62	345	2,090	1,020	260	135	195	69	51
7	60	40	62	56	500	2,090	1,020	251	135	170	73	50
8	61	46	62	49	625	1,980	960	230	135	165	79	49
9	61	52	62	49	810	2,120	900	215	116	135	79	48
10	61	57	62	62	900	1,980	840	310	116	135	96	47
11	61	56	62	62	575	1,800	710	292	99	195	56	46
12	62	54	56	62	725	1,720	725	269	99	178	30	45
13	62	52	47	62	810	1,670	675	245	99	155	44	44
14	63	51	56	69	960	1,760	660	210	99	135	62	44
15	63	49	62	62	1,190	1,940	750	202	99	135	76	45
16	56	47	62	62	1,430	1,940	810	195	99	116	84	46
17	48	46	62	56	1,470	1,630	650	202	94	116	88	46
18	50	45	62	52	1,350	1,720	625	195	91	111	84	47
19	52	44	62	52	1,230	1,630	575	202	88	111	69	47
20	54	43	62	59	900	1,630	560	210	84	121	56	48
21	45	42	65	69	840	1,900	575	251	88	99	56	48
22	35	42	69	79	700	1,670	575	251	104	84	44	49
23	25	42	62	88	780	1,510	625	282	135	190	44	50
24	34	42	62	91	960	1,430	500	260	104	145	44	50
25	44	42	62	104	1,160	1,270	460	260	91	116	62	50
26	53	43	44	107	1,230	1,270	460	195	94	99	56	50
27	53	44	38	135	1,270	1,190	428	178	88	88	62	49
28	52	45	40	161	1,350	1,120	420	155	99	84	47	49
29	52	.....	40	202	1,430	1,110	400	155	99	88	38	49
30	51	.....	36	202	1,430	990	362	141	99	88	49	49
31	50	.....	49	.....	1,630	.....	362	135	.....	84	.....	49

NOTE.—Daily discharge determined from a rating curve that is very well defined. Discharge estimated or interpolated Jan. 2 to 4, 6 to 9, 11 to 14, 16, 18, 19, 21, 22, 24, 25, 27 to 31; Feb. 2, 3, 5, 6, 8, 9, 11 to 16, 18 to 20, 22, 23, 25 to 27; Mar. 2, 3; Dec. 1, 3 to 5, 7 to 9, 11 to 13, 15 to 18, 20 to 22, 24 to 28, 30, 31. Discharges obtained from discharge measurements for other days between Jan. 1 and Mar. 4 and Dec. 1 and 31.

Monthly discharge of Cache la Poudre River near Fort Collins, Colo., for 1911.

[Drainage area, 495 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	63	25	52.8	0.107	0.12	3,250	C.
February	57	29	44.6	.090	.09	2,480	C.
March	69	36	55.5	.112	.13	3,410	A.
April	202	49	79.6	.161	.18	4,740	A.
May	1,630	178	896	1.81	2.09	55,100	B.
June	2,120	990	1,690	3.41	3.80	101,000	B.
July	1,390	362	724	1.46	1.68	44,500	B.
August	310	135	230	.465	.54	14,100	A.
September	135	84	108	.218	.24	6,430	A.
October	210	84	138	.279	.32	8,480	A.
November	96	30	64.7	.131	.15	3,850	A.
December	53	44	48.5	.098	.11	2,980	C.
The year	2,120	25	345	.695	9.45	250,000	

CACHE LA POUDRE RIVER AT MOUTH OF CANYON, NEAR FORT COLLINS, COLO.

Location.—In sec. 15, T. 8 N., R. 70 W., 3 miles below the intake of the Fort Collins waterworks, 12 miles above Fort Collins, half a mile above mouth of Lewstone Creek.

Records available.—March 15, 1884, to October 15, 1901; February 3, 1910, to December 31, 1911.

Drainage area.—1,060 square miles.

Gage.—An automatic recording gage installed November 30, 1909; datum unchanged. No information available concerning the gage used from 1884 to 1901.

Channel.—Practically permanent.

Discharge measurements.—Made from car and cable.

Winter flow.—Ice causes backwater during the winter months and measurements are made to determine the flow.

Diversions.—There is a court decree for a diversion of 57 second-feet from Cache la Poudre River between this station and the one 3 miles above, and decrees for diversions of 119 second-feet from intervening tributaries. Below the station there are decrees for diversions of 3,105 second-feet from the river. In addition, there are numerous decrees for flood-water diversions.

Cooperation.—From 1884 to 1901 the records were maintained by Prof. L. G. Carpenter of the Colorado State Agricultural College. Since 1910 the records have been furnished by the State engineer, by whom the station is maintained.

Discharge measurements of Cache la Poudre River at mouth of canyon, near Fort Collins, Colo., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 7[a]	C. E. Turner	−0.20	44.2	July 28	C. C. Hezmalhalch	1.85	373
Mar. 7	do	0.88	54.5	Aug. 18	do	1.44	178
Apr. 11	do	1.12	104	Sept. 15	Grieve & Hezmalhalch	1.20	108
27	do	1.29	138	Oct. 14	C. E. Turner	1.18	103
May 17	do	3.02	1,326	Dec. 12[a]	do	1.08	39.6
27	Thos. Grieve	2.92	1,191				

[a] Ice conditions.

Daily gage height, in feet, of Cache la Poudre River at mouth of canyon, near Fort Collins, Colo., for 1911.

[T. R. McKnight, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		0.7	1.45	3.3	3.5	1.6	1.65	1.5	0.65	1.0
2		.7	1.45	3.4	3.5	1.7	1.9	1.5	.9	1.2
3		.85	1.45	3.45	3.25	1.45	1.9	1.35	.9	.95
4		1.0	1.55	3.4	3.4	1.45	1.85	1.3	.85	.7
5	0.7	.95	1.65	3.45	3.15	1.45	1.75	1.3	.9	.7
6	.7	.85	2.05	3.45	3.0	1.55	1.45	1.5	.9	.55
7	.75	.85	2.1	3.4	3.1	1.35	1.5	1.55	.8	.55
8	.95	.8	2.3	3.6	2.95	1.45	1.55	1.4	.9	.55
9	.7	.8	2.15	3.8	2.5	1.45	1.55	1.4	.95	.55
10	.7	.95	2.55	3.65	2.4	1.4	1.35	1.35	1.05	
11	.65	.95	2.35	3.4	2.35	1.4	1.25	1.25		
12	.7	.8	2.3	3.4	2.3	1.5	1.25	1.25		
13	.65	.75	2.4	3.4	2.25	1.55	1.30	1.2	.8	
14	.6	.8	2.6	3.3	2.35	1.45	1.2	1.2	1.05	
15	.6	.85	2.7	3.4	2.3	1.45	1.25	1.15	1.1	
16	.75	.85	2.85	3.6	2.3	1.4	1.25	1.15	1.1	
17	.8	.9	2.9	3.8	2.3	1.4	1.25	1.1	1.1	
18	.85	.85	2.9	3.4	2.15	1.45	1.15	1.15	1.2	
19	.7	.85	2.95	3.25	2.0	1.45	1.15	1.15	1.1	
20	.75	.85	2.65	3.25	2.15	1.4	1.15	1.15	.95	
21	.8	.9	2.55	3.25	2.1	1.4	1.15	1.15	.95	
22	.8	.95	2.5	3.2	2.3	1.5	1.15	1.0	.9	
23	.85	1.0	2.5	3.2	1.95	1.7	1.15	1.15	.9	
24	.8	1.2	2.6	3.15	1.85	1.7	1.25	1.15	.9	
25	.7	1.2	2.6	2.9	1.15	1.7	1.2	1.1	.95	
26	.7	1.2	3.0	2.8	1.53	1.6	1.2	1.05	.85	
27	.8	1.2	2.8	3.0	1.35	1.5	1.15	1.1	.7	
28	.8	1.2	2.75	3.3	1.6	1.5	1.15		.6	
29	.85	1.2	2.9	3.45	1.85	1.5	1.25	.7	.6	
30	.85	1.45	2.95	3.5	1.75	1.55	1.35	.7	.8	
31	.8		3.1		1.65	1.6		.75		

NOTE.—Ice present Jan. 1 to Mar. 4 and Dec. 10 to 31.

Daily discharge, in second-feet, of Cache la Poudre River at mouth of canyon, near Fort Collins, Colo., for 1911.

Day	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	45	45	35	35	198	1,625	1,860	255	278	215	70	70
2	45	45	35	35	198	1,860	1,860	300	400	215	70	70
3	45	45	35	50	198	1,800	1,568	198	400	162	62	60
4	45	45	35	70	235	1,740	1,740	198	375	145	62	60
5	45	45	35	62	278	1,800	1,455	198	325	145	55	60
6	45	45	35	50	490	1,800	1,290	235	198	215	55	50
7	45	45	40	50	520	1,740	1,400	162	215	235	45	50
8	55	45	62	45	660	1,985	1,240	198	235	180	55	50
9	55	45	35	45	555	2,235	810	198	235	180	62	50
10	55	45	35	62	855	2,048	730	180	162	162	80	45
11	55	45	32	62	695	1,740	695	180	130	130	75	45
12	55	45	35	45	660	1,740	660	215	130	130	70	40
13	55	45	32	40	730	1,740	625	235	145	115	62	40
14	55	45	30	45	900	1,625	695	198	115	115	80	40
15	55	45	30	50	990	1,740	660	198	130	102	90	40
16	50	45	40	50	1,140	1,985	660	180	130	102	90	40
17	50	45	45	50	1,190	2,235	660	180	130	90	90	40
18	50	45	50	55	1,190	1,740	555	198	102	102	90	40
19	50	45	35	50	1,240	1,568	460	198	102	102	90	40
20	50	40	40	50	945	1,568	555	180	102	102	62	40
21	45	40	45	55	855	1,568	520	180	102	102	62	40
22	45	40	45	62	810	1,510	660	215	102	70	55	40
23	45	40	50	70	810	1,510	430	300	102	102	55	40
24	45	40	45	115	900	1,455	162	300	130	102	55	40
25	45	40	35	115	900	1,190	102	300	115	90	62	40
26	45	40	35	115	1,290	1,090	235	255	115	80	50	40
27	45	40	45	115	1,090	1,290	162	215	102	80	50	40
28	45	40	45	115	1,040	1,625	255	215	102	80	50	40
29	45	.....	50	115	1,190	1,800	375	215	130	80	50	40
30	45	.....	50	198	1,240	1,860	325	235	162	80	50	40
31	45	.....	45	.....	1,400	.....	278	255	.....	80	.....	40

NOTE.—Daily discharge estimated because of ice Jan. 1 to Mar. 4 and Dec. 10 to 31. Discharge Nov. 11–12 interpolated because of missing gage heights.

Monthly discharge of Cache la Poudre River at mouth of canyon, near Fort Collins, Colo., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	55	45	48	2,980
February	45	40	43	2,410
March	62	30	40	2,460
April	198	35	69	4,120
May	1,400	198	819	50,400
June	2,240	1,090	1,710	102,000
July	1,860	102	764	47,000
August	300	162	218	13,400
September	400	102	173	10,300
October	235	70	126	7,720
November	90	45	65	3,880
December	70	40	46	2,800
The year	2,240	30	343	249,000

LOUP RIVER AT COLUMBUS, NEBR.

Location.—At highway bridge in sec. 25, T. 17 N., R. 1 W., at Columbus, Nebr. No tributaries between the station and the mouth of the river 3 miles below.

Records available.—October 13, 1894, to December 31, 1911.

Drainage area.—13,500 square miles.

Gage.—A chain gage installed at the highway bridge June 24, 1904, and set to read the same as the original vertical staff gage, which was located 1½ miles above the bridge and was used from October 13, 1894, to that date. Owing to the slope of the river, however, the datum of the chain gage is 8.56 feet lower than that of the upper gage.

Channel.—Extremely shifting.

Discharge measurements.—Made from highway bridge.

Winter flow.—Ice causes backwater during the winter months and observations are discontinued.

Diversions.—Prior to September 1, 1912, there were approved diversions of 1,764 second-feet for irrigation and 4,700 second-feet for power from Loup River above the station. There were also approved diversions of 2,046 second-feet for irrigation and 3,130 second-feet for power, from tributaries entering above.

Accuracy.—The extremely shifting channel makes it impossible to make estimates of daily discharge without almost weekly measurements, as the gage heights afford only an approximate indication of the flow.

Cooperation.—During 1911 the station was maintained in cooperation with the State engineer, by whom the field data were furnished.

Discharge measurements of Loup River at Columbus, Nebr., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 23	A. A. Dobson	4.22	2,980	July 31	A. B. Price	4.10	1,900
Apr. 25	A. B. Price	4.45	2,470	Aug. 10	do	4.40	2,580
May 18	do	3.90	2,730	25	do	4.30	2,270
26	do	4.50	2,610	Sept. 11	do	4.70	3,320
June 13	do	4.50	2,180	24	do	4.40	2,070
21	do	4.30	1,970	Oct. 4	do	4.40	2,450
July 8	do	4.35	1,460	Nov. 10	do	4.40	4,170

Daily gage height, in feet, of Loup River at Columbus, Nebr., for 1911.

[W. D. Benson, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		4.4	5.25	4.5	4.15	3.95	4.0	4.4		
2		4.4	4.55	4.6	4.1	4.05	4.25	4.4	4.5	
3		4.35	4.45	4.5	4.2	4.25	4.4	4.45		
4		4.5	4.5		4.15	4.15	4.3	4.4	4.2	
5		4.6	4.65	4.6	4.2	4.25	4.45	4.65	4.15	
6		4.4	4.75	4.55	4.2	4.2		6.5	4.45	
7		4.3	4.65	4.6		4.4	4.4	5.95	4.45	
8		4.3	4.6	4.65	4.35	4.45	4.4	5.0	4.45	4.45
9		4.35	4.5	4.4	4.55	4.35	4.8	4.8	4.2	4.2
10			4.3	4.45	4.45	4.5	5.55	4.3	4.25	4.35
11		4.35	4.25	4.4	4.8	4.4	4.65	4.55		4.5
12	4.6		4.35	4.5	4.45	4.3	4.8	4.35		4.7
13	4.45	4.5		4.5	4.3	4.4	4.35	4.4		4.75
14	4.6	4.55	6.0	4.5	5.35		4.3	4.55		4.6
15	4.6	4.5	4.45	4.45	4.5	4.35	4.35	4.6		4.55
16	4.75	4.45		4.3	4.7	4.35	4.15	4.65		4.5
17	4.55	4.5	3.85	4.3	5.0	4.15	4.25	4.8	4.5	4.2
18	4.5	4.4	4.25	4.45	4.7	4.1	4.35	4.65		
19	4.3	4.5		4.45	4.5	4.25	4.35	4.7		4.45
20	4.15	4.55	4.15	4.4	4.65	4.5	4.3	4.8	4.9	
21	4.0	4.45	4.4	4.35	4.45	4.65	4.35	4.75	4.7	4.8
22	4.5	4.4	4.9	4.3	4.3	4.5	4.4	4.6	4.3	4.65
23		4.4	5.65	4.25		4.75		4.65		4.6
24	4.2	4.45	4.35	4.25	5.1	4.55	4.4	4.7		4.4
25	4.2	4.45	4.35	4.35	4.8	4.3	4.4	4.75		4.65
26	4.4	4.5	4.5	4.5	4.65	4.25	4.4	4.75		
27	4.4	4.45	4.7	5.1	4.45	4.2	4.4	4.6		
28	4.45		4.7	4.95	4.2	4.3	4.4	4.5		
29	4.45	4.55	4.75	4.55	4.0		4.6	4.5		
30	4.45	4.75	4.65	4.3	4.0	4.2	4.6	4.6		
31	4.4		4.7		4.0	3.85		4.3		

NOTE.—Ice caused backwater at gage Nov. 11 to Dec. 31.

ELKHORN RIVER AT WATERLOO, NEBR.

Location.—At the highway bridge half a mile north of Waterloo on the line between secs. 3 and 10, T. 15 N., R. 10 E. No tributary within several miles.

Records available.—May 19 to December 31, 1911.

Drainage area.—Not measured.

Gage.—Chain gage; datum unchanged.

Channel.—Extremely shifting.

Discharge measurements.—Made from the highway bridge.

Winter flow.—Records not of sufficient length to determine effect of ice.

Diversions.—Prior to September 1, 1912, there were approved diversions of 147 second-feet for irrigation and 538 second-feet for power from Elkhorn River above the station. From the tributaries entering above there were approved diversions of 174 second-feet for power development.

Accuracy.—Daily discharge computed indirectly and can be considered only approximate.

Cooperation.—Station maintained by the State engineer, by whom the field data are furnished.

Discharge measurements of Elkhorn River at Waterloo, Nebr., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 19	A. B. Price	3.00	1,060	Aug. 9	A. B. Price	1.40	537
30	do	2.60	930	28	do	1.50	425
June 12	do	1.90	655	Sept. 12	do	1.30	303
23	do	2.10	844	Oct. 3	do	1.60	491
July 8	do	1.60	598	Nov. 9	do	2.10	920
31	do	1.40	434				

Daily gage height, in feet, of Elkhorn River at Waterloo, Nebr., for 1911.

[John Todd, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.50	4.00	1.30	1.51	1.60	2.13	2.90
2		2.45	3.75	1.28	1.50	1.65	2.13	2.70
3		2.40	3.55	1.37	1.45	1.65	2.15	2.60
4		2.35	2.90	1.48	1.40	1.68	2.12	2.90
5		2.37	2.34	1.40	1.30	1.70	2.10	2.90
6		2.33	2.05	1.50	1.28	1.90	2.15	2.86
7		2.35	1.90	1.60	1.35	2.05	2.14	2.98
8		2.15	1.70	1.64	1.32	2.10	2.20	2.65
9		2.10	1.50	1.69	1.38	2.20	2.20	2.68
10		2.05	1.75	1.60	1.40	2.55	2.27	2.98
11		2.00	1.67	1.54	1.40	2.55	2.20	3.05
12		1.90	1.70	1.50	1.41	2.60	1.50	2.81
13		1.90	1.77	1.50	1.54	2.40	2.24	2.96
14		1.90	1.75	1.47	1.46	2.28	2.40	2.77
15		1.85	1.70	1.44	1.38	2.10	2.45	2.61
16		1.76	1.75	1.44	1.34	2.05	2.45	2.61
17		2.35	1.73	1.46	1.36	2.00	2.35	2.67
18		2.50	1.65	1.54	1.32	2.00	2.45	2.52
19	3.00	3.40	1.64	1.64	1.30	2.00	2.45	2.35
20		2.75	1.60	2.02	1.30	2.01	2.36	2.40
21		2.35	1.55	1.58	1.35	2.10	2.30	2.30
22		2.30	1.50	1.47	1.28	2.00	2.40	2.38
23		2.10	1.50	1.40	1.32	2.20	2.40	2.24
24	3.35	1.90	1.58	1.40	1.40	2.18	1.73	2.20
25	3.30	1.90	1.55	1.46	1.40	2.18	2.10	2.26
26	3.20	1.84	1.56	1.45	1.42	2.15	2.45	2.15
27	3.10	1.70	1.54	1.40	1.41	2.16	2.33	2.80
28	3.00	2.50	1.46	1.56	1.38	2.15	2.40	3.15
29	2.70	3.75	1.40	1.50	1.40	2.10	2.69	3.06
30	2.60	4.25	1.40	1.50	1.47	2.18	2.90	3.28
31	2.57		1.31	1.50		2.10		3.30

NOTE.—Gage heights distorted by ice Nov. 12, 24, 25, 29, 30, and Dec. 1 to 31.

Daily discharge, in second-feet, of Elkhorn River at Waterloo, Nebr., for 1911.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	840	3,420	380	417	480	963
2	.....	800	3,080	400	410	520	963
3	.....	860	2,810	460	380	520	985
4	.....	820	1,920	540	350	544	952
5	.....	830	1,300	510	300	560	930
6	.....	900	980	590	292	730	985
7	.....	920	830	660	325	880	974
8	.....	740	650	720	310	930	1,040
9	.....	780	500	770	340	1,040	1,040
10	.....	740	700	690	350	1,490	1,120
11	.....	700	630	640	350	1,490	1,040
12	.....	660	650	610	356	1,560	1,060
13	.....	660	710	560	438	1,290	1,090
14	.....	660	700	545	386	1,140	1,290
15	.....	620	650	520	340	930	1,360
16	.....	545	700	520	320	880	1,360
17	.....	1,100	680	490	330	830	1,220
18	.....	1,280	610	560	310	830	1,360
19	1,060	2,420	610	630	300	830	1,360
20	1,170	1,580	580	960	300	840	1,240
21	1,280	1,100	540	580	325	930	1,160
22	1,390	1,050	500	500	292	830	1,290
23	1,500	840	500	450	310	1,040	1,290
24	1,600	660	570	450	350	1,020	1,310
25	1,540	660	540	386	350	1,020	1,340
26	1,400	630	550	380	362	985	1,360
27	1,400	560	530	350	356	996	1,200
28	1,280	1,340	460	452	340	985	1,290
29	960	2,980	435	410	350	930	1,200
30	860	3,670	435	410	392	1,020	1,200
31	900	.....	380	410	.....	930	.....

NOTE.—Daily discharge determined from a series of parallel rating curves poorly defined; discharge interpolated May 20 to 23, Nov. 12, 24, 25, 29, and 30.

Monthly discharge of Elkhorn River at Waterloo, Nebr., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
May 19–31	1,600	860	1,260	32,500	D.
June	3,670	545	1,060	63,100	D.
July	3,420	380	908	55,800	D.
August	960	350	533	32,800	D.
September	438	292	344	20,500	D.
October	1,560	480	935	57,500	D.
November	1,360	930	1,170	69,600	D.
December	.....	.....	1,000	61,500	
The period	.....	.....	.....	393,000	

KANSAS RIVER BASIN.

REPUBLICAN RIVER AT BOSTWICK, NEBR.

Location.—At highway bridge about 1 mile southwest of Bostwick, on the line between secs. 22 and 23 in T. 1 N., R. 8 W. Nearest tributary a small intermittent stream which enters a short distance below.

Records available.—June 6, 1904, to December 31, 1911. From June 20, 1896, to November 30, 1903, a station was maintained at Superior, 10 miles downstream. As there are no important tributaries nor diversions between, the records at the two points are very nearly comparable.

Drainage area.—23,300 square miles.

Gage.—Chain gage; datum unchanged.

Channel.—Shifting at intervals.

Discharge measurements.—Made from bridge.

Winter flow.—Ice causes backwater during the winter months and during that period the observations are discontinued.

Diversions.—Prior to September 1, 1912, there were approved diversions of 862 second-feet for irrigation and 150 second-feet for power from Republican River above the Bostwick station.

Accuracy.—During 1911 the channel did not shift to any great extent and the estimates of discharge should be reliable.

Cooperation.—During 1911 this station was maintained in cooperation with the State engineer, by whom the field data were furnished.

Discharge measurements of Republican River at Bostwick, Nebr., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 8	A. A. Dobson	0.91	384	Aug. 8	A. B. Price	9.28	15,500
May 14	A. B. Price	1.70	367	Sept. 17	do	3.00	1,700
June 7	do	1.30	129	Nov. 1	do	1.20	293
July 22	do	1.85	413				

Daily gage height, in feet, of Republican River at Bostwick, Nebr., for 1911.

[J. W. Keifer, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.9	2.2	3.2	1.5	1.5	1.3	0.9	2.6	2.2	1.7	1.2	1.5
2	1.9	1.9	3.0	1.5	1.4	1.3	.9	2.0	2.0	1.3	1.2	1.5
3	1.9	1.9	2.0	1.5	1.5	1.4	.9	9.65	1.8	1.3	1.2	1.5
4	1.9	1.9	2.0	1.5	1.5	1.3	.8	9.3	1.7	1.2	1.2	1.2
5	1.9	1.9	1.9	1.5	1.6	1.3	.8	9.92	1.7	1.2	1.2	1.2
6	1.9	2.0	1.9	1.5	1.6	1.3	.8	[a]10.0	1.8	1.2	1.2	1.3
7	1.9	2.0	1.9	1.5	1.6	1.3	.8	9.15	1.6	1.2	1.2	1.3
8	1.9	1.9	2.0	1.6	1.6	1.3	.7	9.45	1.5	1.3	1.2	1.3
9	1.9	1.7	2.0	1.7	1.6	1.3	.9	9.52	1.7	3.4	1.1	1.4
10	1.9	1.7	1.9	1.7	1.6	1.2	.9	8.92	2.0	2.5	1.2	1.4
11	1.9	1.7	1.9	1.7	1.6	1.2	1.0	6.95	1.7	2.0	1.2	1.5
12	1.9	1.7	1.8	1.7	1.6	1.1	1.0	4.7	2.0	1.8	1.3	1.4
13	1.9	1.8	1.8	1.7	1.6	1.1	4.2	3.8	4.5	1.7	1.3	1.4
14	1.9	1.9	1.8	1.6	1.7	1.1	2.7	3.4	3.0	1.5	1.3	1.4
15	.....	1.9	1.7	1.6	1.6	1.0	3.0	4.2	2.4	1.4	1.3	1.4
16	1.9	1.9	1.7	1.6	1.6	1.0	4.6	3.3	2.2	1.4	1.3	1.4
17	.....	1.9	1.7	1.5	1.6	1.0	3.7	3.0	2.0	1.3	1.3	1.4
18	.....	1.9	1.7	1.5	2.0	1.0	2.9	2.8	1.9	1.3	1.3	1.3
19	2.1	1.8	1.7	1.5	1.9	1.2	2.4	3.0	1.9	1.3	1.3	1.4
20	2.1	2.2	1.7	1.5	1.8	1.1	2.1	3.7	1.9	1.3	1.3	1.3
21	2.1	1.9	1.6	1.5	1.7	1.9	2.0	3.6	1.8	1.3	1.3	1.3
22	2.1	2.0	1.6	1.5	1.6	1.8	1.9	3.5	1.7	1.2	1.3	1.3
23	2.1	2.0	1.6	1.5	1.6	1.6	4.0	3.3	1.7	1.2	1.3	1.4
24	2.1	1.9	1.6	1.4	1.5	1.5	2.8	4.2	1.7	1.2	1.4	1.5
25	2.1	2.0	1.6	1.4	1.5	1.3	3.0	3.1	1.4	1.2	1.4	1.5
26	2.3	2.0	1.6	1.4	1.4	1.2	3.5	2.7	1.4	1.2	1.4	1.5
27	2.2	2.0	1.6	1.3	1.5	1.1	4.0	2.4	1.4	1.2	1.4	1.4
28	2.2	1.6	1.5	1.4	1.5	1.1	2.8	2.3	1.3	1.1	1.5	1.4
29	2.2	.....	1.5	2.0	1.4	1.1	2.5	2.4	1.3	1.1	1.5	1.4
30	2.2	.....	1.5	1.9	1.4	1.0	2.5	2.4	1.4	1.1	1.5	1.4
31	2.2	.....	1.5	.....	1.4	.....	2.2	2.5	.....	1.2	.....	1.4

[a] Maximum reading 10.1.

NOTE.—Backwater from ice Jan. 1 to Feb. 1 and Nov. 24 to Dec. 31.

Daily discharge, in second-feet, of Republican River at Bostwick, Nebr., for 1911.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct	Nov.
1	.....	1,930	240	240	160	55	1,130	850	510	280
2	.....	1,650	240	200	160	55	550	700	320	280
3	.....	550	240	240	200	55	16,700	570	320	280
4	.....	550	240	240	160	40	15,700	510	280	280
5	470	470	240	290	160	40	17,400	510	280	280
6	550	470	240	290	160	40	17,600	570	280	280
7	550	470	240	290	160	40	15,100	460	280	280
8	470	550	290	290	160	25	16,200	410	320	280
9	340	550	340	290	160	55	16,400	510	2,210	250
10	340	470	340	290	120	55	14,500	700	1,130	280
11	340	470	340	290	120	70	9,200	510	700	280
12	340	400	340	290	90	70	4,300	700	570	320
13	400	400	340	290	90	3,400	2,790	3,900	510	320
14	470	400	290	340	90	1,260	2,210	1,690	410	320
15	470	340	290	290	70	1,650	3,400	1,030	360	320
16	470	340	290	290	70	4,100	2,070	850	360	320
17	470	340	240	290	70	2,640	1,690	700	320	320
18	470	340	240	550	70	1,520	1,450	630	320	320
19	400	340	240	470	120	910	1,690	630	320	320
20	720	340	240	400	90	630	2,640	630	320	320
21	470	290	240	340	470	550	2,490	570	320	320
22	550	290	240	290	400	470	2,350	510	280	320
23	550	290	240	290	290	3,100	2,070	510	280	320
24	470	290	200	240	240	1,390	3,400	510	280	.....
25	550	290	200	240	160	1,650	1,810	360	280	.....
26	550	290	200	200	120	2,350	1,340	360	280	.....
27	550	290	160	240	90	3,100	1,030	360	280	.....
28	290	240	200	240	90	1,390	940	320	250	.....
29	.....	240	550	200	90	1,010	1,030	320	250	.....
30	.....	240	470	200	70	1,910	1,030	360	250	.....
31	.....	240	.....	200	.....	720	1,130	.....	280	.....

NOTE.—Daily discharge determined from rating curves well defined from Feb. 5 to Aug. 10, and fairly well defined from Aug. 11 to Nov. 2.

Monthly discharge of Republican River at Bostwick, Nebr., for 1911.

[Drainage area, 23,300 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
January	.....	.....	300	0.013	0.02	18,400	D.
February	720	290	459	.020	.02	25,300	C.
March	1,930	240	463	.020	.02	28,500	B.
April	550	160	273	.012	.01	16,200	B.
May	550	200	285	.012	.01	17,500	B.
June	470	70	150	.0064	.007	8,930	B.
July	4,100	25	1,080	.046	05	66,400	B.
August	17,600	550	5,850	.251	.29	360,000	C.
September	3,900	320	708	.030	.03	42,100	C.
October	2,210	250	424	.018	.02	26,100	C.
November	320	250	299	.013	.01	17,800	C.
December	.....	.....	250	.011	.01	15,400	D.
The year	17,600	25	888	.038	.50	643,000	

NOTE.—Discharge Feb. 1 to 4 estimated at 400 second-feet per day. Discharge Nov. 24 to 30 estimated at 300 second-feet. Means for January and December estimated and are only approximate.

BIG BLUE RIVER AT BEATRICE, NEBR.

Location.—At Sixth Street bridge at Beatrice, Nebr. Nearest tributary a small stream entering from the north a mile or more below.

Records available.—October 15, 1910, to December 31, 1911. Records of gage heights have been kept by the United States Weather Bureau from January 1 to July 31 of each year since June 1, 1905.

Drainage area.—3,363 square miles (United States Weather Bureau).

Gage.—Chain gage, owned by the United States Weather Bureau.

Channel.—Shifting.

Discharge measurements.—Made from bridge.

Winter flow.—Ice causes some backwater during a portion of the winter months.

Flood discharge.—The highest recorded stage was 25.6 feet above the present gage datum, and occurred May 29, 1903.

Diversions.—Prior to September 1, 1912, there were approved diversions of 841 second-feet for power, from the Big Blue above Beatrice; below, the approved diversions amount to 500 second-feet for power.

Accuracy.—Although the channel is shifting sufficient measurements have been obtained to make estimates of discharge which are fair.

Cooperation.—Station maintained in cooperation with the State engineer, by whom the field data are furnished.

Discharge measurements of Big Blue River at Beatrice, Nebr., in 1911.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 21	A. A. Dobson	1.32	289	July 3	A. B. Price	0.75	161
Apr. 7	do	1.38	305	Aug. 2	do	1.70	505
May 1	A. B. Price	1.60	403	Sept. 16	do	2.30	839
June 9	do	1.30	307	Oct. 31	do	1.50	316

Daily gage height, in feet, and discharge, in second-feet, of Big Blue River at Beatrice, Nebr., for 1910.

[H. E. Palmer, observer.]

Day.	October.		November.		December.		Day.	October.		November.		December.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
1			1.3	325	1.4	365	16	1.4	365	1.3	325	1.3	325
2			1.3	325	1.3	325	17	1.4	365	1.4	365	1.3	325
3			1.3	325	1.3	325	18	1.6	450	1.4	365	1.3	325
4			1.2	290	1.3	325	19	1.5	405	1.3	325	1.1	260
5			1.2	290	1.3	325	20	1.4	365	1.3	325	1.2	290
6			1.2	290	1.3	325	21	1.3	325	1.3	325	1.3	325
7			1.2	290	1.2	290	22	1.3	325	1.3	325	1.1	260
8			1.2	290	1.2	290	23	1.3	325	1.3	325	1.1	260
9			1.3	325	1.2	290	24	1.2	290	1.3	325	1.1	260
10			1.3	325	1.3	325	25	1.3	325	1.3	325	1.2	290
11			1.3	325	1.4	365	26	1.4	365	1.3	325	1.2	290
12			1.3	325	1.3	325	27	1.4	365	1.3	325	1.2	290
13			1.3	325	1.3	325	28	1.4	365	1.4	365	1.3	325
14			1.2	290	1.3	325	29	1.4	365	1.4	365	1.3	325
15	1.4	365	1.2	290	1.4	365	30	1.4	365	1.4	365	1.2	290
							31	1.4	365			1.2	290

Daily gage height, in feet, of Big Blue River at Beatrice, Nebr., for 1911.

[H. E. Palmer, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.3	1.4	1.4	1.3	1.6	1.1	1.0	1.9	1.7	3.8	1.2	1.4
2	.....	1.4	1.5	1.2	1.7	1.2	1.0	1.7	1.5	5.1	1.2	1.0
3	.....	1.3	1.4	1.2	1.8	1.1	.9	1.4	1.5	3.6	1.1	1.3
4	.....	1.4	1.3	1.3	1.8	1.1	.8	1.3	1.5	2.4	1.0	1.4
5	.....	1.4	1.2	1.1	1.8	1.7	.7	1.4	1.5	2.3	1.1	1.4
6	.....	1.3	1.3	1.2	1.7	1.2	.8	1.4	1.4	2.2	1.2	1.5
7	.....	1.3	1.3	1.3	1.6	1.1	.9	1.4	1.4	2.2	1.2	1.3
8	.....	1.2	1.3	1.3	1.5	1.1	1.0	1.9	1.5	2.2	1.2	1.2
9	.....	1.2	1.4	1.4	1.4	1.0	1.0	2.4	1.4	2.3	1.2	1.2
10	1.5	1.2	1.4	1.0	1.5	1.1	.9	2.4	2.9	2.2	1.2	1.4
11	1.7	1.3	1.4	1.2	1.7	1.3	.8	2.2	2.0	.....	1.1	1.4
12	1.7	1.3	1.4	1.2	1.6	1.1	.9	2.0	2.9	2.3	1.2	1.4
13	1.8	1.3	1.5	1.3	1.4	1.1	.9	2.0	2.5	2.6	1.2	1.4
14	1.8	1.4	1.4	1.3	1.4	1.1	.9	2.1	2.4	3.2	1.2	1.4
15	1.9	1.8	1.3	1.4	1.4	1.1	1.0	1.7	2.4	1.6	1.2	1.3
16	2.1	2.0	1.3	1.3	1.3	1.1	1.0	1.5	2.4	1.4	1.2	1.3
17	2.1	2.2	1.3	1.2	1.3	1.1	1.0	1.4	2.4	1.3	1.2	1.3
18	2.0	2.0	1.3	1.2	1.3	1.0	.8	1.3	2.2	1.4	1.2	1.3
19	1.6	2.1	1.3	1.3	1.3	1.0	.8	1.3	2.2	1.3	1.3	1.4
20	1.4	1.5	1.2	1.3	1.2	.9	1.0	1.4	1.8	1.3	1.3	1.5
21	1.4	1.2	1.2	1.3	1.2	.9	1.0	1.5	1.5	1.3	1.2	1.5
22	1.3	1.5	1.3	1.2	1.2	1.0	.9	1.8	1.4	1.2	1.2	1.5
23	1.3	1.6	1.3	1.3	1.2	1.1	24.0	2.5	1.4	1.1	1.2	1.4
24	1.3	1.7	1.2	1.2	1.2	1.0	(a)	1.7	1.3	1.1	1.2	1.2
25	1.3	1.7	1.3	1.2	1.3	.9	8.7	1.8	1.2	1.0	1.3	1.2
26	1.5	1.6	1.3	1.1	1.3	.8	3.7	1.9	1.3	1.1	1.3	1.3
27	1.4	1.5	1.3	1.3	1.3	.9	3.3	2.0	1.3	1.1	1.2	1.7
28	1.4	1.2	1.2	1.3	1.2	.9	3.1	2.0	1.3	1.2	.5	1.9
29	1.4	.....	1.3	1.3	1.2	.9	2.8	2.1	1.3	1.1	.9	1.7
30	1.3	.....	1.3	1.8	1.2	.9	2.4	2.0	1.4	1.2	1.0	1.6
31	1.4	.....	1.2	.....	1.1	.....	2.3	1.9	.....	1.3	.....	.....

[a] Gage not read, as trees lodged against the gage.

NOTE.—Ice present Jan. 2 to 18 and Dec. 26 to 31.

Daily discharge, in second-feet, of Big Blue River at Beatrice, Nebr., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	365	365	325	450	260	230	605	500	2,160	290	365
2	.....	365	405	290	500	290	230	500	405	3,460	290	230
3	.....	325	365	290	550	260	200	365	405	1,960	260	325
4	.....	365	325	325	550	260	175	325	405	920	230	365
5	.....	365	290	260	550	500	150	365	405	850	260	365
6	.....	325	325	290	500	290	175	365	365	780	290	405
7	.....	325	325	325	450	260	200	365	365	780	290	325
8	.....	290	325	325	405	260	230	605	405	780	290	290
9	.....	290	365	365	365	230	230	920	365	850	290	290
10	.....	290	365	230	405	260	200	920	1,300	780	290	365
11	.....	325	365	290	500	325	175	780	660	815	260	365
12	.....	325	365	290	450	260	200	660	1,300	850	290	365
13	.....	325	405	325	365	260	200	660	990	1,060	290	365
14	.....	365	365	325	365	260	200	720	920	1,580	290	365
15	.....	550	325	365	365	260	230	500	920	450	290	325
16	.....	660	325	325	325	260	230	405	920	365	290	325
17	.....	780	325	290	325	260	230	365	920	325	290	325
18	.....	660	325	290	325	230	175	325	780	365	290	325
19	450	720	325	325	325	230	175	325	780	325	325	365
20	365	405	290	325	290	200	230	365	550	325	325	405
21	365	290	290	325	290	200	230	405	405	325	290	405
22	325	405	325	290	290	230	200	550	365	290	290	405
23	325	450	325	325	290	260	22,400	990	365	260	290	365
24	325	500	290	290	290	230	14,700	500	325	260	290	290
25	325	500	325	290	325	200	7,060	550	290	230	325	290
26	405	450	325	260	325	175	2,060	605	325	260	325	.....
27	365	405	325	325	325	200	1,670	660	325	260	290	.....
28	365	290	290	325	290	200	1,480	660	325	290	310	.....
29	365	.....	325	325	290	200	1,220	720	325	260	330	.....
30	325	.....	325	550	290	200	920	660	365	290	350	.....
31	365	.....	290	.....	260	.....	850	605	.....	325	.....	.....

NOTE.—Daily discharge determined from a rating curve that is fairly well defined below 1,000 second-feet; discharge estimated Nov. 28 to 30.

Monthly discharge of Big Blue River at Beatrice, Nebr., for 1910–11.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1910.					
October	450	290	361	22,200	C.
November	365	290	323	19,200	B.
December	365	260	310	19,100	B.
1911.					
January	450	.....	325	20,000	C.
February	780	290	415	23,000	B.
March	405	290	332	20,400	B.
April	550	260	316	18,800	B.
May	550	260	375	23,100	B.
June	500	175	250	14,900	B.
July	22,400	150	1,830	113,000	C.
August	990	325	560	34,400	B.
September	1,300	290	569	33,900	B.
October	3,460	230	736	45,300	C.
November	350	230	294	17,500	B.
December	405	.....	331	20,400	C.
The year	22,400	150	531	385,000	

NOTE.—Discharge Oct. 1 to 14 estimated at 365 second-feet. Discharge Jan. 1 to 18 and Dec. 26 to 31 estimated at 300 and 275 second-feet, respectively.

LITTLE BLUE RIVER NEAR FAIRBURY, NEBR.

Location.—At highway bridge in sec. 26, T. 2 N., R. 2 E., 1½ miles south of Fairbury. Nearest tributary a small stream entering half a mile above.

Records available.—May 23, 1908, to December 31, 1911.

Drainage area.—Not measured.

Gage.—Chain gage; datum unchanged.

Channel.—Shifting.

Discharge measurements.—Made from bridge.

Winter flow.—Ice causes backwater for only a short time during the winter months.

Artificial control.—The dam of the Fairbury Roller Mills, located 2 miles above, may control the flow to a certain extent during the low-water season, causing a daily fluctuation. The gage is read once each day.

Diversions.—Prior to September 1, 1912, there were approved diversions of 180 second-feet for power from the Little Blue above Fairbury. There were none below.

Accuracy.—Estimates have been made by indirect method for shifting channels, and can be considered only fair.

Cooperation.—Station maintained in cooperation with the State engineer, by whom the field data are furnished.

Discharge measurements of Little Blue River near Fairbury, Nebr., in 1911.

Date.	Hydrographer.	Gage-height.	Discharge.	Date.	Hydrographer.	Gage-height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 28	A. A. Dobson	3.52	187	July 12	A. B. Price	2.60	94.7
Mar. 30	do	2.96	129	Aug. 7	do	5.65	926
Apr. 15	do	2.99	145	Sept. 15	do	3.50	300
May 7	D. D. Price	3.20	133	Oct. 31	do	3.00	180
June 8	A. B. Price	2.80	129				

Daily gage height, in feet, of Little Blue River near Fairbury, Nebr., for 1911.

[Clark Hulbert, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.1	3.2	3.3	3.0	4.8	2.9	2.5	3.2	3.5	9.5	3.0	2.9
2	3.2	3.1	3.6	3.0	3.7	2.8	2.4	3.0	3.4	6.4	2.9	3.0
3	.....	3.0	3.1	2.9	3.3	2.8	2.6	3.2	3.3	4.1	3.0	3.1
4	.....	3.0	3.1	3.0	3.3	2.8	2.5	3.1	3.7	3.5	3.0	3.3
5	.....	3.1	3.0	3.0	3.3	3.0	2.4	3.0	3.4	3.3	3.0	3.0
6	.....	3.1	3.1	3.1	3.2	2.9	3.2	6.1	3.3	3.3	3.1	3.0
7	.....	3.0	3.1	2.9	3.1	2.9	2.5	6.4	3.3	3.2	3.0	3.1
8	.....	3.0	3.1	3.0	3.1	2.8	2.4	4.8	3.4	3.1	3.0	2.9
9	3.6	3.0	3.1	2.9	3.9	2.8	2.6	5.3	3.3	3.1	2.9	3.0
10	3.3	3.1	3.1	3.1	3.3	2.9	2.6	5.0	4.3	3.2	2.9	3.1
11	3.5	3.1	3.0	3.1	3.1	2.8	2.7	4.3	3.3	3.1	3.0	3.1
12	3.7	3.0	3.1	3.0	3.1	2.7	2.5	3.9	3.2	3.1	2.8	3.0
13	3.4	3.1	3.0	3.0	3.0	2.8	2.6	3.7	3.2	3.3	3.0	3.0
14	3.9	3.2	3.0	2.9	3.0	2.7	2.7	3.5	3.5	3.1	2.9	3.0
15	3.4	3.1	3.1	3.0	3.1	2.7	2.5	3.4	3.5	3.0	3.1	3.1
16	3.4	3.3	3.1	3.0	3.1	2.7	4.3	3.3	3.4	3.1	3.1	3.1
17	3.7	3.4	3.0	3.0	3.0	2.7	3.5	3.3	3.3	3.1	3.2	3.0
18	3.5	3.4	3.1	3.0	3.0	2.7	3.5	3.2	3.2	3.0	3.1	3.0
19	3.4	3.2	2.9	2.9	2.9	2.8	3.2	3.7	3.1	3.0	2.9	3.0
20	3.2	3.1	3.0	3.0	2.9	2.8	3.6	6.9	3.2	3.1	3.0	3.1
21	3.3	3.1	3.1	2.9	3.0	2.6	3.5	7.25	3.2	3.1	3.0	3.1
22	3.5	3.3	3.1	2.9	3.0	2.7	3.3	9.2[a]	3.0	2.9	3.0	2.9
23	3.6	3.4	3.0	3.0	3.0	2.7	3.2	6.3	3.0	2.8	3.0	3.0
24	3.4	3.4	3.0	2.9	3.0	2.7	8.7	5.8	3.0	2.9	2.9	3.0
25	3.2	3.5	2.9	2.9	2.9	2.6	4.6	5.2	3.0	3.0	3.0	2.9
26	3.2	3.2	3.0	3.0	2.9	2.3	4.4	4.7	3.0	3.0	2.9	3.0
27	3.2	3.1	2.9	3.0	2.9	2.6	4.4	4.2	2.9	3.1	2.9	3.1
28	3.5	3.4	3.0	3.0	2.9	2.6	3.9	4.0	3.0	3.0	2.9	3.1
29	3.1	.....	3.0	3.1	2.9	2.5	3.4	3.8	2.9	3.0	3.0	3.1
30	3.4	.....	2.9	5.5	3.0	2.5	3.3	3.6	3.2	2.9	2.6	3.4
31	3.2	.....	2.9	.....	2.9	.....	3.2	3.6	.....	3.0	.....	3.3

[a] Maximum reading, 9.6.

NOTE.—River frozen over Jan. 3 to 8 and Dec. 30 and 31.

Daily discharge, in second-feet, of Little Blue River near Fairbury, Nebr., for 1911.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	125	150	175	145	450	125	90	200	290	3,340	190	180
2	135	140	220	145	225	115	80	190	270	1,360	180	190
3	144	130	150	130	165	115	100	215	250	420	190	200
4	153	130	150	145	165	115	90	200	320	280	190	230
5	162	140	135	145	165	135	80	190	270	230	190	190
6	171	140	150	160	150	125	175	1,140	250	230	200	190
7	180	130	150	130	140	130	90	1,290	250	215	190	200
8	188	130	150	145	125	120	80	575	270	200	190	180
9	195	130	150	130	250	120	100	770	250	200	180	190
10	150	140	150	160	150	130	100	650	470	215	180	200
11	180	140	135	160	125	120	110	425	250	200	190	200
12	210	130	150	145	125	110	90	330	225	200	170	190
13	165	140	135	145	115	120	110	290	250	230	190	190
14	250	150	135	130	115	110	120	260	300	200	180	190
15	165	140	150	145	125	110	100	245	300	190	200	200
16	165	165	150	135	125	110	380	230	285	200	200	200
17	210	180	135	135	115	110	235	230	270	200	215	190
18	180	180	150	135	130	110	235	215	255	190	200	190
19	165	150	125	125	115	120	190	290	240	190	180	190
20	135	140	135	135	115	120	250	1,640	255	200	190	200
21	150	140	150	125	130	100	235	1,840	255	200	190	200
22	180	165	150	125	130	110	200	3,110	230	180	190	180
23	195	180	135	135	130	110	200	1,300	230	170	190	190
24	165	180	135	125	130	110	2,670	1,040	230	180	180	190
25	135	195	125	125	115	100	490	770	230	190	190	180
26	135	150	135	135	115	70	440	580	230	190	180	190
27	135	110	125	130	115	100	410	430	220	200	180	200
28	180	180	135	130	125	100	320	380	230	190	180	200
29	140	.....	135	140	125	90	230	330	220	190	190	200
30	180	.....	125	680	135	90	215	290	255	180	150	200
31	150	.....	130	.....	125	.....	200	290	.....	190	.....	200

NOTE.—Daily discharge determined from a series of parallel rating curves and by the indirect method for shifting channels; discharge interpolated for days for which gage heights are missing.

Monthly discharge of Little Blue River near Fairbury, Nebr., for 1911.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	250	125	167	10,300	D.
February	195	130	150	8,330	D.
March	220	125	144	8,850	D.
April	680	125	156	9,280	D.
May	450	115	147	9,040	D.
June	135	70	112	6,660	D.
July	2,670	80	272	16,700	D.
August	3,110	190	643	39,500	D.
September	470	220	262	15,600	C.
October	3,340	170	347	21,300	C.
November	215	150	187	11,100	C.
December	230	180	194	11,900	C.
The year	3,340	70	233	169,000	

MISCELLANEOUS MEASUREMENTS.

Miscellaneous measurements in Missouri River drainage basin in 1911.

Missouri River proper.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Apr. 7[a]	Missouri River	Mississippi River.	Kansas City, Mo.	[b] 8.85	48,700

Upper Missouri drainage basin.

July 12	Red Rock River	Beaverhead River.	Twitchell's ranch near Monida, Mont.	.....	140

Dearborn River drainage basin.

Jan. 16	Fish Creek	Dearborn River.	Clemons, Mont.	.....	13
Mar. 20	Middle Fork Dearborn River.	....do	Stearns, Mont.	.....	26
June 6	....do	....do	....do	.....	94

Sun River drainage basin.

Oct. 23	South Fork of North Fork of Sun River.	North Fork of Sun River.	1 mile above the fork near Warm Springs, Mont.	1.06	137
23	North Fork of North Fork of Sun River.	....do	....do	89.1	127
22	North Fork Sun River.	Sun River.	Sun River Canyon, near Augusta, Mont.	76.58	346
Mar. 20	DuBray Creek	South Fork of Sun River.	Highway bridge near Augusta, Mont.	.....	20
June 7	....do	....do	....do	.....	141

Marias River drainage basin.

May 12	Dupuyer ditch	.....	Above Lake Frances near Valier, Mont.	.....	37
13	Teton Cooperative canal.	.....	Near Strabane, Mont.	.....	22
June 21	....do	.....	....do	.....	128

[a] Made at Hannibal Railroad bridge near foot of Broadway, Kansas City, Mo. Measurement by G. L. Parker.

[b] St. Louis directrix is 303.3 feet below zero of the gage.

Miscellaneous measurements in Missouri River drainage basin in 1911.—Continued.

Judith River drainage basin.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
May 4	Big Spring Creek	Judith River	Lewistown, Mont		185

Milk River drainage basin.

Apr. 18	Wolf Creek ditch		Near Wolf Point, Mont	2.10	0.50
May 17	do		do	2.17	1.7
June 15	do		do	2.17	1.8

Yellowstone River drainage basin.

May 31	East Boulder River	Boulder River.	Near McLeod, Mont	−0.2	15.7
Sept. 5	Bighorn canal		Near headgates near St. Xavier, Mont.	2.6	67
Mar. 30	West Boulder River	Boulder River.	Bruffeys, Mont	1.19	47
Nov. 3	Little Wind River	Popo Agie River.	Near Fort Washakie, Wyo		[a] 35.0
3	Sage Creek	Little Wind River.	Fort Washakie, Wyo		[a] 10.0
Oct. 15	Popo Agie River	do	Above mouth at Arapahoe, Wyo.		160
15	Torrey Creek	do	Dubois, Wyo		[a] 25.0
15	Red Creek	do	do		[a] 5.0
15	Meadow Creek	do	J. K. Ranch, Wyo		[a] 15.0
Nov. 3	Bull Lake Creek	do	do		[a] 30.0
4	Dry Creek	Wind River	Crowheart, Wyo		[a] 20.0
June 21	Poison Creek	Bighorn River	Shoshoni, Wyo		[a] 3.0
Oct. 28	South Fork of Paint Rock Creek.	Paint Rock Creek.	Near Hyattville, Wyo		[a] 10.0
28	East Fork of Paint Rock Creek.	do	do		[a] 10.0
28	Paint Rock Creek	No Wood Creek.	Below confluence of Southeast Fork of Paint Rock Creek, Wyo.		47.7

White River basin, South Dakota.

Aug. 27	Keya Paha River	White River	Sec. 34, T. 38 N., R. 26 W		9.0
28	Little White River	do	Sec. 23, T. 41 N., R. 29 W		65

Platte River drainage basin.[b]

June 11	Beaver Creek	North Platte River.	Encampment, Wyo		39.9
21	do	do	do		35.0
July 12	do	do	do		[a] .8
June 21	Deer Creek	do	Near Glenrock, Wyo		15.0
July 2	Box Elder Creek	do	Careyhurst, Wyo		[a] 3.0
20	do	do	do		[a] 3.0
June 22	La Prele Creek	do	Near Inez, Wyo		3.0
22	Elkhorn Creek	do	Near Bona, Wyo		1.0
May 20	Horseshoe Creek	do	Haufs Spur, near Glendo, Wyo	2.00	15.6
21	do	do	do	1.98	13.5
June 23	do	do	do	1.40	12.0
22	Cottonwood Creek	do	Badger, Wyo		[a] .5
Oct. 19	do	do	do		[a] 3.0
May 22	Laramie River	do	Uva, Wyo		12.5
June 23	do	do	do		48.9
July 2	do	do	do		4.7
21	do	do	do		10.7
Oct. 19	do	do	do		[a] 8.0
July 20	Horseshoe Creek	do	Haufs Spur, Wyo		[a] 1.0
Oct. 19	do	do	Cassa, Wyo		[a] 2.0
May 12	North Platte River	Missouri River	Bridgeport, Nebr	[c] 5.25	833
June 26	do	do	do	[c] 5.33	1,220
Apr. 26	do	do	Henry, Nebr	[c] 1.30	640
June 14	do	do	do	[c] 2.05	1,220

[a] Discharge estimated. [b] See also p. 235. [c] Gage height from State gage.

Miscellaneous measurements in Missouri River drainage basin in 1911—Continued.

Platte River drainage basin—Continued.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Jan. 10	North Fork of South Platte River.	South Platte River.	South Platte, Colo	a 2.52	46.1
Feb. 22	do	do	do	a 1.96	29.9
Mar. 16	do	do	do	a 1.00	52.4
May 10	do	do	do	2.75	269
Aug. 18	do	do	do	2.00	116
29	do	do	do	1.90	83.4
Nov. 4	do	do	do	1.62	46.1
Dec. 16	do	do	do	a 2.70	28.8
Apr. 14	Threemile Creek	Geneva Creek	Near Grant, Colo		1.4
July 13	do	do	do		7.7
Sept. 8	Geneva Creek	North Fork of South Platte River.	Grant, Colo		33.4
8	do	do	do		33.5
July 14	Craig Park Creek	do	Estabrook, Colo		b 9.0
12	Ditch at Cassells, Colo.	From North Fork of South Platte River.	Cassells, Colo		12.5
12	do	Brandy Creek power house.	do		.6
	do	Total flow			13.1
	do	Waste			.3
	do	Water to turbine.			12.8
Apr. 13	Deer Creek	North Fork of South Platte River.	Crossons, Colo		b 4.0
14	do	do	do		b 5.0
July 4	do	do	do		b 5.0
5	do	do	do		b 7.0
14	do	do	do		b 8.0
Apr. 14	Elk Creek	do	Pine Grove, Colo		b 4.0
July 4	do	do	do		b 5.0
Apr. 14	Buffalo Creek	do	Near Buffalo, Colo		b 4.0
July 12	do	do	do		b 2.0
July 27	Tarryall Creek	South Platte River.	Robbins ranch, near Jefferson, Colo.	.95	49.8
9	Twin Creek	do	Lake George, Colo		b .25
12	Turkey Creek	do	Pine Grove, Colo		b 7.0
12	Chicago Creek	do	Idaho Springs, Colo		b 4.0
12	Soda Creek	do	do		b 4.0
Sept. 23	North Fork of Clear Creek.	do	Mouth at Empire station, Colo		b 10.0
23	Middle Fork of Clear Creek.	do	Mouth at Georgetown, Colo		b 50.0
23	South Fork of Clear Creek.	do	do		b 50.0
Mar. 1	North Clear Creek	Clear Creek	Forkscreek, Colo		b 3.0
13	do	do	do		25.7
June 29	do	do	do		b 7.0
Aug. 12	do	do	do		b 5.0
Sept. 23	do	do	do		b 6.0
Nov. 8	do	do	do		b 8.0
Dec. 22	do	do	do		b 1.0
May 13	Roscoe Creek	do	10 miles above Golden, Colo		0
13	Elk Creek	do	8 miles above Golden, Colo		b .5
13	Beaver Creek	do	7½ miles above Golden, Colo		b 2.0
Sept. 22	do	do	do		0
Nov. 8	do	do	do		b .5
Sept. 22	Golden Creek	do	Golden, Colo		0
Dec. 22	Clear Creek	South Platte River.	do		b 15.0
Oct. 1	South Boulder Creek	do	Pine Cliff, Colo		b 10.0
1	do	do	Rollinsville, Colo		b 15.0
1	Lump Gulch Creek	South Boulder Creek.	do		b 3.0
Apr. 1	Lonetree Creek	Clear Creek	Greeley, Colo		b 1.0
1	Crow Creek	do	Kersey, Colo		0

a Ice conditions. b Estimated.

The following measurements of streams and ditches along North Platte River from the Wyoming State line to Kearney, Nebr., were made by R. H. Fletcher from September 15 to October 12, 1911. The capacity of the ditches was determined by Kutter's formulas, values of N=0.020 to 0.030, values of S=0.0005 to 0.002. For ditches that were dry the value of S was determined by levels taken to high-water marks in ditches.

Measurements of streams and irrigation ditches along North Platte River from Wyoming State line to Kearney, Nebr., in 1911.

Date.	Stream or ditch.	Location.	Discharge.	Capacity.
			Second-feet.	*Second-feet.*
Sept. 15	North Platte River	Henry, Nebr	1,007	
15	do	Morrill, Nebr	513	
17	do	Mitchell, Nebr	710	
18	do	Scottsbluff, Nebr	879	
19	do	Minatare, Nebr	699	
21	do	Bayard, Nebr	573	
22	do	Bridgeport, Nebr	457	
24	do	Lisco, Nebr	529	
25	do	Oshkosh, Nebr	559	
27	do	Lewellen, Nebr	646	
29	do	Keystone, Nebr	638	
Oct. 6	do	North Platte, Nebr	3,505	
10	do	Gothenburg, Nebr	2,408	
12	do	Kearney, Nebr	1,492	
Sept. 16	Dry Sheep Creek	Morrill, Nebr	19	
27	Blue Creek	Lewellen, Nebr	84	
27	do	do	(mouth) Dry.	
28	Otter Creek	Le Moyne, Nebr	Est. 15	
28	Lonergan Creek	do	Est. 4	
28	Spring or Sand Creek	do	Est. 2	
28	Whitetail Creek	Keystone, Nebr	Est. 12	
14	Mitchell ditch	Henry, Nebr. (highway)	118	276
14	do	Henry, Nebr. (head gate)	120	289
14	Gering ditch	Henry, Nebr	130	268
15	Tri-State ditch	do	432	1,359
16	do	Morrill, Nebr	417	1,053
17	do	Mitchell, Nebr	395	
15	Ramshorn ditch	Morrill, Nebr	Dry.	75
16	Enterprise ditch	Morrill, Nebr. (head gate)	Dry.	328
17	do	Mitchell, Nebr. (1 mile below head gate).	24	118
16	do	Morrill, Nebr	Est. 20	
17	Winters Creek ditch	Scotts Bluff, Nebr		213
17	Homestead ditch	do	Abandoned.	
18	Central Irrigation and Power ditch.	Opposite Scotts Bluff, Nebr. (head gate).	Dry.	49
18	do	Gering, Nebr. (below wasteway).	Dry.	46
18	Steamboat ditch	Minatare, Nebr	Dry.	118
18	Castlerock ditch	do	60	210
19	Minatare ditch	do	Dry.	178
19	North Fork Minatare ditch	do	Dry.	92
19	South Fork Minatare ditch	do	Dry.	58
19	Ninemile ditch	do	91	238
19	Short Line ditch	Bayard, Nebr	Dry.	41
20	Chimneyrock ditch	do	Est. 15	143
20	Alliance ditch	do	45	99
20	Belmont ditch	do	72	255
22	do	Bridgeport, Nebr	50	133
20	Empire ditch	Bayard, Nebr	Dry.	23
21	Schemerhorn ditch	Northport, Nebr	Dry.	57
21	H. T. Clark ditch	do	Dry.	Abandoned.
21	Browns Creek ditch	do	79	163
23	Beerline ditch	Broadwater, Nebr	Dry.	49
23	Lees Creek ditch	do	Dry.	13
23	Lisco Irrigation Co. ditch	Lisco, Nebr	Dry.	154
24	Hannah ditch	do	Dry.	Abandoned.
24	Rush Creek ditch	do	Dry.	26
25	Wilcox ditch	do	Dry.	Abandoned.
25	Spohn ditch	Oshkosh, Nebr	Dry.	43
25	Lyons ditch	do	Dry.	Abandoned.
25	Oshkosh or Robinson Gumaer ditch.	do	Dry.	31

Measurement of streams and irrigation ditches along North Platte River from Wyoming State line to Kearney, Nebr., in 1911—Continued.

Date.	Stream or ditch.	Location.	Discharge.	Capacity.
			Second-feet.	*Second-feet.*
25	Gyger ditch	Oshkosh, Nebr	Dry.	Abandoned.
26	Roberts or Midland ditch	do	17	Full capacity.
26	Overland ditch	do	Dry.	Abandoned.
26	Bushnell ditch	do	Dry.	Abandoned.
26	Signal Bluff ditch	do	Dry.	Abandoned.
28	Robins-Williams ditch	Lewellen, Nebr	Dry.	Abandoned.
26	Alfalfa Irrigation ditch	do	Est. 12	72
27	Vance-Orr ditch	do	Est. 2	17
28	Holcomb ditch	Le Moyne, Nebr	Dry	Abandoned.
28	Meyers-Phelas ditch	Martin, Nebr	Dry.	Abandoned.
28	Fernstrom or Nisson ditch	do	Dry.	Abandoned.
29	Southerland or Paxton ditch	Keystone, Nebr	73	171
29	Sheridan or Wilson ditch	Sarben, Nebr	Dry.	Abandoned.
Oct. 1	South Side ditch	Southerland, Nebr	Dry,	Abandoned.
1	North Platte or old ditch canal.	do	83	189
1	Hershey ditch	do	83	Full capacity.
2	Farmers-Merchants or Suburban ditch.	Hershey, Nebr	Dry.	145
9	Gothenburg ditch	Brady, Nebr	82	265
11	Farmers and Merchants ditch	Cozad, Nebr	Dry.	306
12	Kearney ditch	Kearney, Nebr	86	546

Blue Creek ditches.

Sept. 27	Ramsey ditch	Lewellen, Nebr	Est. 7	Est. 75
27	Equitable, etc., ditch	do	35	Full capacity.
27	Iowa Improvement Irrigation ditch.	do	About 2	Est. 30
26	Meeker or Graf ditch	do	26	Full capacity.

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